AN EMPIRICAL INVESTIGATION OF THE ASSOCIATION BETWEEN REPORTED EARNINGS AND CORPORATE BOND PRICES

By

DARREL WILBER DAVIS

Bachelor of Arts
University of Northern Iowa
Cedar Falls, Iowa
1965

Master of Arts
University of Northern Iowa
Cedar Falls, Iowa
1969

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
DOCTOR OF PHILOSOPHY
July, 1975

AN EMPIRICAL INVESTIGATION OF THE ASSOCIATION

BETWEEN REPORTED EARNINGS AND

CORPORATE BOND PRICES

Thesis Approved:

Thesis Adviser

Dean of the Graduate College

ACKNOWLEDGMENTS

My sincere appreciation is expressed to:

The members of my doctoral committee (Drs. E. F. Baskin, Chairman, James R. Boatsman, Herbert Jelley, and Joseph Jadlow) for their guidance, suggestions and encouragement,

Dr. Wilton T. Anderson, Head, Department of Accounting, for his confidence in my abilities and generosity with fellowship and computer facility funds,

Ernst & Ernst for the dissertation grant which facilitated the completion of this study and eased the financial concerns of my family considerably,

The Price Waterhouse Foundation which through the University of Northern Iowa provided the financial encouragement to initiate a doctoral program, and

The University of Northern Iowa Professional Development Committee and the administrative officials who provided both time to complete degree requirements and financial assistance.

Special gratitude is expressed to:

Dr. James T. Blanford, University of Northern Iowa, for his many, many administrative efforts on my behalf and for the teaching leadership and example he has provided,

Dr. Gaylon Halverson, University of Northern Iowa, for his encouragement and unselfish efforts to provide every requested bit of assistance,

Mr. John O. Everette, Ph.D. Candidate, Oklahoma State University, for his timely programming assistance,

Mr. James McDonald, Ph.D. Candidate, Oklahoma State University, for his willingness to "react" to ideas and proposals--regardless of the hour, and

The several other Oklahoma State University Ph.D. Candidates whose friendship meant so much.

Particular thanks are appropriate for my parents, Mr. and Mrs. Randall L. Davis, for their continued encouragement and support whenever and wherever needed.

Two other very special people assumed additional responsibilities and made sacrifices which made it possible for me to concentrate on the degree requirements. To Kay, my wife, and Carla Marie, my daughter, thank you for your patience and love.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Purpose of the Research

In recent years a sizeable volume of empirical research regarding accounting information and its relationship to common stock prices has been reported in the literature. The research reported has in general dealt with the question of whether common stock investors perceive accounting reports--especially earnings announcements--as containing information relevant to the investment decision and, if so, whether that information is efficiently impounded in common stock prices.

The research reported upon to date involves two basic approaches to ascertaining the value of accounting information to investors. The first approach is to observe the price and trading volume fluctuations of selected securities over a period of time which includes the period of the earnings announcement. The basic hypothesis of this methodology is that if accounting earnings announcements contain data which investors and potential investors perceive to have information value, that information will be reflected in the securities markets through common stock price or trading volume fluctuations or both.

The second basic approach to the question of the value of accounting data as represented by earnings announcements is a "quality-of-earnings" approach. The basic hypothesis of this approach is that if the capital markets are efficient and investors are able to see through

reported earnings to the economic events which give rise to the income figures, accounting policy decisions cannot give rise to earnings reports which will mislead the market, i.e., the market-determined value of common stocks will not be a function of the particular set of alternative generally accepted accounting principles (GAAP) selected for reporting results of operations.

The purpose of this study is to contribute to the evidence which exists regarding the efficiency of securities markets with respect to accounting data. This study is an attempt to extend the efficient capital markets research as it relates to accounting information to the corporate bond markets.

The Need for This Research

To the present time all of the published capital market research with respect to accounting information has been conducted with data from the common stock markets. The results of this research have been generalized, however, to the "securities" markets, a broader generalization than is justified by the scope of the investigations. To the extent that the term "securities" is applicable to both stocks and bonds issued to raise capital and to the extent that additional corporate capital may be raised through either the stock or bond markets, the generalization of research results from stock market based research to the more inclusive "securities" markets is tenuous. Until empirical research with bond market data is completed and reported, those who draw conclusions with respect to the efficient impounding of accounting earnings announcements in "security" prices probably do not have a solid basis for their conclusions. Furthermore, any recommendations

to accounting rule-making bodies based on these conclusions must either ignore the corporate bond market, assess it as being insignificant or assume on the basis of a priori reasoning that the bond market, as does the common stock market, efficiently impounds earnings announcements in bond prices.

The Significance of the Corporate Bond Market as an External Source of Additional Investor Capital

It does not seem prudent to ignore the bond market as a significant source of corporate investment capital. Over the ten-year period 1964 through 1973 corporate bonds represented sixty-seven percent of effective corporate securities for cash sale registrations with the Securities and Exchange Commission (SEC). That is, approximately two-thirds of SEC approved securities registrations by existing firms seeking additional investment capital were bond registrations. (See Table I, page 4.) While the proportion of bonds to the total effective securities registrations with the SEC has declined in recent years-- to fifty-two percent in 1973--there can be little question that the bond market still represents a significant source of corporate capital and is too important a source of capital to be ignored or left to assumption when making accounting policy recommendations.

The Significance of the Study

In addition to the contribution this research is expected to make by being the first reported research dealing with bond market efficiency with respect to annual earnings announcements, it is also

TABLE I

EFFECTIVE CORPORATE REGISTRATIONS FOR CASH SALE BY TYPE OF SECURITY

$ millions
(percent of total for year)

FISCAL YEAR	TOTAL REGISTRATIONS	REGISTRATIONS BY TYPE OF SECURITY		
		BONDS	COMMON STOCK	PREFERRED STOCK
1964	5,086	4,020 (79%)	854 (17%)	212 (4%)
1965	5,347	3,154 (59%)	1,893 (35%)	300 (6%)
1966	8,779	6,257 (71%)	2,158 (25%)	364 (4%)
1967	13,440	11,462 (85%)	1,484 (11%)	494 (4%)
1968	16,363	12,603 (77%)	2,854 (17%)	906 (6%)
1969	17,282	10,818 (63%)	5,949 (34%)	515 (3%)
1970	25,975	17,825 (69%)	7,382 (28%)	768 (3%)
1971	38,201	27,139 (71%)	7,722 (20%)	3,340 (9%)
1972	30,572	18,386 (60%)	10,028 (33%)	2,158 (7%)
1973	26,456	13,862 (52%)	10,019 (38%)	2,575 (10%)
TEN-YEAR SUMMARIZATION		67%	27%	6%

Source: Securities and Exchange Commission, Annual Report of the Securities and Exchange Commission, Vols. 29-38, Washington, D. C.: U. S. Government Printing Office, 1964-1973

anticipated that this study will add to the growing volume of knowledge regarding general market efficiency with respect to accounting data. As Beaver and Dukes state in assessing the contribution of some of their own research:

> . . . (A)lthough considerable evidence supports market efficiency in general, there are few tests of market efficiency with respect to accounting data. The efficient market hypothesis is convincing largely because of the volume and consistency of empirical evidence supporting it across a variety of contexts. Hence it is important to document market efficiency with respect to accounting data as well.[1]

This study is an attempt to extend efficient capital market research into the bond market. And, at the same time, this study will add to the already existing evidence of "securities" market efficiency with respect to accounting data where "securities" are defined in a broader sense to include stocks and corporate bonds.

Literature Review

The accounting literature which reports research regarding market efficiency with respect to accounting data may be divided into two very distinct and yet fundamentally related categories. Research which answers the question, "Do investors act upon published financial data?" falls in the first category, i.e., research concerned with whether data contained in accounting reports made public by publicly held corporations are perceived by investors as having information content and, therefore, of use in the process of investment decision-making. The research classified in the second category seeks to answer the

---

[1]William H. Beaver and Roland E. Dukes, "Interperiod Tax Allocation and δ-Depreciation Methods: Some Empirical Results," The Accounting Review, XLVIII (July,1973), p. 557.

question, "What effect do changes in accounting techniques have on investor decisions?" Research to evaluate the positive aspects of the use of accounting data in investment decisions is important because of a market efficiency implication that investors will act on any relevant information available to them and ignore irrelevant data. If investors are found to disregard accounting information in formulating their investment decisions, the accounting information system might be considered irrelevant. If, however, investors are found to perceive accounting data as information relevant to the investment decision-making process, the allocation of resources to facilitate efforts to provide more timely or meaningful data or data at a lower cost may be justified.

Investors' Perceptions of Accounting Data as Useful Information

Although accountants naturally share the belief that accounting reports contain information which is used by investors in their individual investment decision processes and in their evaluation of corporate performance, skeptics argue otherwise. For example, some would argue that accounting data is only an insignificant portion of all information bearing upon the firm's economic environment and position. These skeptics suggest that industry production statistics, order backlogs, consumer-oriented product analyses, the state of the national or local economies, and other of the innumerable statistics publicly and privately disseminated to investors render accounting data to be of only minor significance at most in the investment decisions of investors.

Fama, Fisher, Jensen, and Roll were among the first to apply the market model of Markowitz as refined by Sharpe and Lintner to examine or measure the announcement effect of information items, specifically stock splits and dividend announcements.[2] The evidence reported by Fama, et al., indicates that once the news of a stock split or dividend was made public, that information was quickly and efficiently impounded in stock prices in such a manner that shortly after the announcement no abnormal return could be earned based solely on knowledge of the stock split or dividend.[3]

Ball and Brown also used an efficient capital markets methodology to examine the information content of published annual net income figures.[4] In describing their research Ball and Brown make the following statement in regard to using the efficient capital markets research as a basis for their own research.

> An impressive body of theory supports the proposition that capital markets are both efficient and unbiased in that if information is useful in forming capital asset prices, then the market will adjust asset prices to that information quickly and without leaving any opportunity for further abnormal gain. If, as the evidence indicates, security prices do in fact adjust rapidly to new information as it becomes available, then changes in security prices will reflect the flow of information to the market. An observed revision of stock prices associated with the release of the

---

[2]William H. Beaver, "The Behavior of Security Prices and its Implications for Accounting Research (Methods)," Report of the Committee on Research Methodology in Accounting, The Accounting Review, Supplement to Vol. XLVII (1972), p. 412.

[3]Eugene F. Fama, Lawrence Fisher, Michael Jensen, and Richard Roll, "The Adjustment of Stock Prices to New Information," International Economic Review, X (February, 1969), pp. 20-21.

[4]Ray Ball and Philip Brown, "An Empirical Evaluation of Accounting Income Numbers," Journal of Accounting Research, VI (Autumn, 1968), pp. 159-178.

income report would thus provide evidence that the information reflected in income numbers is useful.[5]

The evidence gathered by Ball and Brown demonstrated that the information contained in the annual income number is useful to investors. Specifically, Ball and Brown found evidence that when actual firm income differs in either direction from expected income (greater than or less than), the common stock price typically reacted in the same direction.[6]

The Ball and Brown study was based on various assumptions, one of the most restrictive of which may be the earnings expectations model used to predict investors' income expectations. Beaver was able to circumvent the problem of specifying an earnings prediction model by investigating the effect of earnings announcements on stock prices and the volume of stock traded without regard to the firm earnings expectations of investors.[7]

Beaver, defining information in the same manner as did Ball and Brown--that which changes investors' expectations-- hypothesized that if annual earnings announcements contain information which investors (1) consider relevant to the investment decision and which (2) causes changes in their expectations as to the future of the firm--earnings, growth, risk--those investors will rearrange their investment portfolios.[8] Beaver proposed to detect this rearangement of investor

---

[5]Ibid., pp. 160-161.

[6]Ibid., pp. 169-170.

[7]William H. Beaver, "The Information Content of Annual Earnings Announcements," Empirical Research in Accounting: Selected Studies, 1968, Supplement to Vol. VI, Journal of Accounting Research, pp. 67-92.

[8]This definition of information adopted by Beaver and Ball and

portfolios through an observation of both stock trading volumes and stock price relatives around the period of the earnings announcement date of each firm in his sample. The volume test is distinct from the price test in that the former reflects changes in the expectations of the market as a whole while the latter reflects changes in the expectations of individual investors. A piece of information might be neutral in terms of not changing the expectations of individual investors, a fact which, though not necessarily reflected in price changes, would be reflected in the volume of trading transactions. Beaver concludes from the results of his research that, "The dramatic price and volume reaction indicates that investors do look directly at reported earnings and do not use other variables to the exclusion of reported earnings."[9]

Other researchers have corroborated investor reaction to the announcement or publication of accounting-based financial data. Brown and Kennelly,[10] May,[11] and Kiger[12] in separate research efforts

---

Brown is consistent with the communication theory definition which defines the information content of a message as a function of the change in the expectations of the receiver as a result of receiving the message. See C. E. Shannon and W. Weaver, The Mathematical Theory of Communication (Urbana, Illinois, 1964).

[9]William H. Beaver, "The Information Content of Annual Earnings Announcements," p. 84.

[10]Philip Brown and John W. Kennelly, "The Information Content of Quarterly Earnings: An Extension and Some Further Evidence," Journal of Business, XLV (July, 1972), pp. 403-415.

[11]Robert G. May, "The Influence of Quarterly Earnings Announcements on Investor Decisions as Reflected in Common Stock Price Changes," Empirical Research in Accounting: Selected Studies, 1971, Supplement to Vol. IX, Journal of Accounting Research, pp. 119-163.

[12]Jack E. Kiger, "An Empirical Investigation of NYSE Volume and Price Reactions to the Announcement of Quarterly Earnings," Journal of Accounting Research, X (Spring, 1972), pp. 113-128.

conducted with various modifications of the Beaver or Ball and Brown methodologies found that quarterly earnings announcements or earnings-per-share reports convey new and useful information to the stock market. All three research efforts confirmed Beaver's conclusions with respect to other sets of accounting data, i.e., investors appear to impound these other sets of data in their investment decision processes.

In summary, the above cited research is evidence that common stock investors perceive accounting statements as containing information relevant to the investment decision process. Given this perception of accounting data as containing information of value, other researchers have attempted to determine if investors' decisions are a function of the particular alternative generally acceptable accounting method employed to report the results of operations. The focus of this research has been to determine if the information stockholders perceive to be contained in accounting data is efficiently impounded in stock prices in such a manner as to reflect the economic substance of reported events without being influenced by the method chosen to report the event.

Efficiency of Investor Impounding Accounting-Based Information in Security Prices

Because generally accepted accounting procedures (GAAP) encompass many alternative accounting methods, corporate managers are able to exercise considerable discretion over the manner in which their financial results are measured and reported. Given a choice among alternative depreciation policies, inventory valuation methods, and other

revenue and expense recognition alternatives a firm's results of operations and financial position may be reported in several different "generally accepted" ways. A question of considerable significance to corporation managers, security analysts, and accountants is whether investors' investment decisions are influenced by a change from one accounting technique to another, e.g., a switch from accelerated to straight-line asset depreciation procedures, even though the underlying economic situation of the firm may be unchanged.

If investors are influenced in their decision making processes by such accounting policy decisions, it is clearly inconsistent with the hypothesis that the capital markets are efficient. The efficient capital markets hypothesis holds that astute investors are able to make use of the disclosure of accounting policy changes required by Accounting Principles Board Opinion 20 and make appropriate adjustments in their assessment of securities.[13] Thus, if market efficiency correctly characterizes the securities markets, investors are able to see through the numbers to the underlying economic realities, and firms will not be able to systematically affect security prices by selecting from among alternative generally acceptable accounting methods. If this is the case, corporate managers need not be concerned with the effect on the price of their firm's securities of accounting rule-making bodies' decisions to eliminate as generally accepted accounting alternatives particular accounting techniques which management considers desirable alternatives in presenting the results of their operations to investors and potential investors.

---

[13]Accounting Principles Board, APB Opinion No. 20: Accounting Changes (New York, July, 1971).

The extent of the widespread belief that investors are influenced by GAAP alternatives in their decision-making processes is attested to in many sources. A recent Wall Street Journal editorial makes a direct reference to the extent of the belief among corporate executives that the way to maximize security prices is to maximize reported earnings, even if this merely involves a choice of the most favorable of generally accepted accounting alternatives.

> . . .(A) myth has grown up that the way a corporation maximizes its share price is to maximize its reported earnings. This is of course not entirely untrue, but it depends on what the earnings reflect. A lot of executives apparently believe that if they can figure out a way to boost reported earnings their stock price will go up even if the higher earnings do not represent any underlying economic change. In other words, the executives think they are smart and the market is dumb.[14]

Patz and Boatsman also refer to the widespread belief in market inefficiency with respect to accounting alternatives.[15] They report that perusal of the testimony of investment bankers, oil company executives, representatives of public accounting firms, and other interested parties before the Accounting Principles Board Committee on Extractive Industries and a review of the position papers submitted to the Committee ". . .indicates there is a large and knowledgeable group. . . who perceive alternative accounting principles as real economic variables rather than as mere bookkeeping phenomena."[16] Beaver and Dukes also

---

[14]"The Market, Smart or Dumb?" The Wall Street Journal, October 1, 1974, p. 14.

[15]Dennis Patz and James R. Boatsman, "Accounting Principles Formulation in an Efficient Markets Environment," Journal of Accounting Research, X (Autumn, 1972), pp. 392-403.

[16]Ibid., p. 394.

refer to ". . .the widespread belief in market inefficiency with respect to accounting data. . ." in assessing the significance of their study of interperiod tax allocation and depreciation methods.[17]

The early studies of the possible effects of alternative accounting methods on investor decisions were conducted primarily in experimental settings. Dyckman, in a series of studies he conducted, presented security analyst participants with a set of financial statements identical except for inventory valuation methods.[18] In his first and third studies Dyckman reported finding that the participants' decisions were influenced by the inventory valuation methods. In the second study the participants appeared to be indifferent to the inventory valuation method used. Bruns[19] and Barrett,[20] in experimental research using students and business men (Bruns) and professional analysts (Barrett), found that accounting method variations did not influence the judgment of decision makers. Jensen, however, examined the effects of alternative inventory and depreciation methods on the

---

[17]William H. Beaver and Roland E. Dukes, p. 557.

[18]T. R. Dyckman, "The Effects of Alternative Accounting Techniques on Certain Management Decisions," Journal of Accounting Research, II (Spring, 1964), pp. 91-107; T. R. Dyckman, "On the Investment Decision," The Accounting Review, XXXIX (April, 1964), pp. 285-295; T. R. Dyckman, "On Effects of Earnings-Trend, Size and Inventory Valuation Procedures in Evaluating a Business Firm," Research in Accounting Measurement, R. K. Jaedicke, Y. Ijiri, and O. Nielsen, editors (Iowa City, Iowa, 1966) pp. 175-185.

[19]William J. Bruns, "Inventory Valuation and Management Decision," The Accounting Review, XL (April, 1965), pp. 345-359.

[20]M. Edgar Barrett, "Accounting for Intercorporate Investments: A Behavior Field Experiment," Empirical Research in Accounting: Selected Studies, 1971, Supplement to Vol. IX, Journal of Accounting Research, pp. 50-65.

investment decisions of security analysts and interpreted the results as indicating that analysts' decisions are affected by alternative accounting techniques.[21]

The results of the experimental studies conducted to determine the effect of alternative accounting techniques on the decision-making process are difficult to assess for at least two reasons. First, the results offer conflicting evidence as to the effect of accounting techniques. Even the same researcher, Dyckman, found that the results of his series of experiments were contradictory. Second, the conclusions reached by those who conducted experimental research must be evaluated in view of the constraints implicit in this type of research design. Because such studies are conducted in artificial environments, often with surrogates for actual decision makers, and are conducted without the same reward and penalty structure which exists in real decision making situations, there is a question as to the external validity of such research designs, i.e., there is some question as to how valid it is to generalize from the results of such research to real situations.

Among the earliest empirical tests of alternative accounting methods and security prices was research conducted by O'Donnell.[22] He examined the price-earnings ratios of twenty-five electric utility firms which used different depreciation and tax-accounting methods and concluded that investors can discern the differences produced by

---

[21] Robert E. Jensen, "An Experimental Design for Study of Effects of Accounting Variations in Decision Making," Journal of Accounting Research, IV (Autumn, 1966), pp. 50-65.

[22] J. L. O'Donnell, "Relationships Between Reported Earnings and Stock Prices in the Electric Utility Industry," The Accounting Review, XL (January, 1965), pp. 135-143.

accounting alternatives. From a sample of airline firms Summers observed that investors were not influenced by different methods of accounting for investment credit, interperiod tax allocation or funds-flow statement presentations.[23] Based on an observation of electric utility stock prices of firms using alternative income tax accounting methods, Mlynarczyk was able to conclude that investors adjust their decision-making processes for measuring variations and thus are not deceived by alternative accounting measures.[24]

Although the above empirical studies appear to support the efficient capital market hypothesis and refute the functional-fixation hypothesis--the alternate hypothesis that investors react only to observed signals and do not adjust their decision-making processes for accounting data produced by alternative accounting methods--methodological shortcomings of the research leave room for some doubt. Specifically, these studies may be subject to criticism for not utilizing control groups as a basis for comparison of results where practical to do so, generally including only small samples selected in a non-random manner, and failing to control for the effect of general market factors on security prices.

Kaplan and Roll were among the first to report the use of the Sharpe-Lintner market model to remove general market effects from

---

[23] Edward L. Summers, "Observation of Effects of Using Alternative Reporting Practices," The Accounting Review, XLIII (April, 1968), pp. 257-265.

[24] F. A. Mlynarczyk, Jr., "An Empirical Study of the Accounting Methods and Stock Prices," Empirical Research in Accounting: Selected Studies, 1969, Supplement to Vol. VII, Journal of Accounting Research, pp. 63-89

security price changes in an empirical study to assess the effect of accounting changes on security prices.[25] By using a larger sample size (332 firms) than previous empirical studies and by using a control group Kaplan and Roll were able to overcome, to some degree, the shortcomings in the preceding research.[26] In general, the results of their study indicated no significant effect of a change in method of accounting for the investment credit or depreciation on investor-determined common stock prices. Ray Ball also used the residual analysis, i.e., an analysis which removed the effect of general market factors from individual security prices, and could conclude that accounting changes do not affect market prices of securities.[27] Patz and Boatsman, in an article previously referred to, used a control group in their research attempt to determine the effect of an Accounting Principles Board's tentative statement of intent to eliminate an extractive industry's accounting alternative.[28] Oil-firm executives and security analysts testified before an APB Committee on Extractive Industries that forcing full-costing firms to discontinue use of that alternative method of accounting for exploration, development and production costs would have adverse effects on the security prices of the full-cost companies and

---

[25]Robert S. Kaplan and Richard Roll, "Investor Evaluation of Accounting Information: Some Empirical Evidence," Journal of Business XLV (April, 1972), pp. 225-257.

[26]Baruch Lev, Financial Statement Analysis (Englewood Cliffs, New Jersey, 1974), p.240.

[27]Ray Ball, "Changes in Accounting Techniques and Stock Prices," Empirical Research in Accounting: Selected Studies, 1972, Supplement to Vol. X, Journal of Accounting Research, pp. 1-38.

[28]Dennis H. Patz and James R. Boatsman, pp. 392-403.

adversely affect their ability to attract additional investment capital through the securities markets. Patz and Boatsman did not note any adverse effect of the APB's tentative statement of position on full-cost firms' stock prices. In interpreting the results of their research they conclude that ". . .a likely interpretation (consistent with the efficient markets hypothesis) is that the market perceived the changes which might ensue from the Board's recommendations as simply bookkeeping changes having no real economic substance."[29]

Although empirical research generally supports market efficiency with respect to accounting data, in a few cases accounting changes are reported to have some effect on stock prices.[30] Additional research is necessary before the question is resolved within tolerable limits of uncertainty.

Acknowledgement of Primary Sources

Many research works contributed to the methodological and theoretical structure of this research. Especially significant as basic source materials which contributed to the construction of the methodology used in this study were the research efforts conducted by Fama,[31] Beaver,[32]

---

[29]Patz and Boatsman, p. 403.

[30]For example, Archibald analyzed market reaction to depreciation switch-back and was unable to reject a hypothesis of no effect of the switch-back on stock prices. T. Ross Archibald, "Stock Market Reaction to the Depreciation Switch-Back," The Accounting Review, XLVII (January, 1972), pp. 22-30.

[31]Eugene F. Fama, "The Behavior of Stock Market Prices," The Journal of Business, XXVIII (January, 1965), pp. 34-105.

[32]William H. Beaver, "The Information Content of Annual Earnings Announcements," pp. 67-92.

May,[33] and Kaplan and Roll.[34] Also of importance as excellent and thorough reviews of theoretical formulations and empirical evidence concerning efficient capital markets are the works of Lev,[35] Beaver,[36] and Fama.[37]

Although the research efforts referred to in the above paragraph gave consideration only to common stocks in analyzing market efficiency with respect to accounting reports, they were of considerable assistance in the formulation of a methodology to be used in this research. By making some basic assumptions it is possible to borrow for use with bond market data a methodology which has been rather extensively and successfully tested and used in stock market research. The existence of this tested methodology increases the probability of finding significant results in this study by the extent to which the methodology has been found to be sound.

Overview of Subsequent Chapters

Chapter II is a development of the theoretical relationships which form the basis for this study and the efficient capital market research which has preceded it. Given these theoretical relationships between information made available to investors and security prices, corporate

---

[33] Robert G. May, pp. 119-163.

[34] Robert Kaplan and Richard Roll, pp. 225-257.

[35] Baruch Lev, Financial Statement Analysis: A New Approach (Englewood Cliffs, New Jersey, 1974).

[36] William H. Beaver, "The Behavior of Security Prices and Its Implications for Accounting Research (Methods)," pp. 407-437.

[37] Eugene F. Fama, "Efficient Captial Markets: A Review of Theory and Empirical Work," Journal of Finance, XXV (May, 1970), pp. 383-417.

bond price changes are hypothesized as being observable evidence that the bond market investors do or do not include corporate earnings announcements as part of the data set which leads to investment decisions.

The hypothesis that bond price changes around the earnings announcement period which exceed expected price changes (as determined by an observed relationship between each bond and a market index) are evidence that corporate earnings announcements have information value to corporate bond investors is advanced in Chapter III. A description of the methodology used to assess the perceptions of bond market investors regarding accounting data is also included in this chapter.

Chapter IV contains a summarization of the statistical tests for the significance of price changes in the period of annual earnings announcement. These statistical results allow inferences to be drawn concerning the impact of annual earnings announcements on corporate bond investors and provide evidence as to the propriety of generalizing stock market efficient capital market research to the "securities" markets. Chapter V concludes this study with a summary of the research results, corresponding conclusions and implications which can be drawn, a recognition of the limitations of the study, and recommendations for further research.

Thus, this research is very much similar in methodology and purpose to the research conducted by others; but, it is conducted in a distinctly separate area of corporation finance, the corporate bond market. Based on the results of studies conducted with stock market data other researchers have concluded that securities markets are efficient and that investors are not influenced by accounting-technique

induced fluctuations in reported results of operations. These conclusions have been cited as support for recommendations to accounting rule-making bodies that these bodies may eliminate as generally acceptable some existing accounting alternatives. The basis of these recommendations that rule-making bodies need not be concerned with the effect such actions might have on the security prices of firms currently using such accounting alternatives or on the ability of these same firms to acquire capital in the public capital markets is research conducted almost exclusively in common stock markets. Action upon these recommendations assumes a generalization of research results to a more general population and may result in pronouncements of accounting standards which are based on incomplete empirical research.

CHAPTER II

THEORETICAL BASIS FOR RESEARCH

Introduction

In this chapter a theoretical model of the investment-decision behavior of corporate bond investors will be specified so that a research methodology to detect possible investor impounding of annual earnings announcements in corporate bond prices may be developed. Before that model is specified, however, other models are presented to explain a priori why corporate bond investors might impound accounting earnings announcements in the market established values of corporate bonds.

Valuation Models for Convertible Industrial Bonds

BMQ Model

An early valuation model for convertible bonds was developed by Baumol, Malkiel and Quandt (BMQ).[1] The convertible bond valuation model offered by BMQ has as one of its primary variables an investor's subjective probability distribution of future market prices of the

---

[1] William J. Baumol, Burton G. Malkiel, and Richard E. Quandt, "The Valuation of Convertible Securities," Quarterly Journal of Economics, LXXX (February, 1966), pp. 48-59.

common stock into which the bond is convertible. The BMQ model suggests that a convertible bond is worth at least the conversion value plus the insurance value of the security as a bond or

$$C_{(t)} \geq P_{(t)}S + V_{(t)}$$

where: $C_{(t)}$ = the value of the convertible at time t,

S = the conversion ratio or the number of shares of common stock into which the convertible may be exchanged,

$P_{(t)}$ = the market price per share of common stock at time t, and

$V_{(t)}$ = the insurance value of the convertible at time t.[2]

The insurance value of the convertible at time t is the value of the security exclusive of the convertible feature.

Thus, the BMQ model includes as a major determinant of convertible bond price the value at the time of valuation of the common stock into which the bond is convertible. Given this variable as a major determinant of convertible bond price, consider a model for determining common stock values. Most such models of common stock investor behavior may be expressed in the following manner.

$$P_{(t)} = f\left\{ E\left[\sum_{t=1}^{n} \frac{EPS(t) - I(t)}{(1 + k)^t} \right] \right\}$$

where: $P_{(t)}$ = the market price per share of stock in time period t,

$EPS_{(t)}$ = earnings per share at period t,

$I_{(t)}$ = investment per share at period t,

k = market discount rate,

E = expected value, and

---

[2] Ibid.

f = the functional relationship between the present value and expected future earnings.[3]

The above equation illustrates the proposition that investors who purchase a share of a company's stock base their valuation on the present value of the firm's expected stream of earnings adjusted for that portion of earnings, $I_{(t)}$, which must be reinvested by the firm to maintain the projected earnings stream. Substituting the model of determining the market value of a share of common stock into the model for valuing a convertible security results in the following model where the value of the convertible security becomes a function of expected earnings plus the non-convertible or insurance value of the security

$$C_{(t)} = f\left\{E\left[S\left(\sum_{t=1}^{n} \frac{EPS_{(t)} - I_{(t)}}{(1+k)^t}\right) + V_{(t)}\right]\right\}$$

where all variables have been previously defined.

Brigham Model

Another model of convertible bond value similar to that formulated by BMQ is the one formulated by Brigham.[4] In his model Brigham specifies a model of convertible bond value as the straight bond value plus the value of the convertible feature

$$C_{(t)} = P_{(0)}\ (1+g)^t\ R + V_{(t)}$$

where: $C_{(t)}$ = conversion value at time t,

$P_{(0)}$ = initial market value of stock,

---

[3] See George C. Philippatos. Financial Management: Theory and Techniques (San Francisco, 1973), p. 368, for a good summary presentation.

[4] Eugene F. Brigham, "An Analysis of Convertible Debentures: Theory and Some Empirical Evidence," The Journal of Finance, XXI (March, 1966), pp. 35-54.

g = rate of growth of the stock's price,

R = conversion ratio, and

$V_{(t)}$ = the insurance or bond value of the security.[5]

If g, the rate of growth of the stock's price, is considered a function of expected earnings of the firm, as it certainly can be, earnings is a piece of information impounded in the price of a convertible bond using either the BMQ or the Brigham model. The BMQ model as modified to reflect the determination of the market price of a share of common stock contains expected earnings-per-share as a key variable, and the Brigham model has as a key variable the stock price rate of growth which is a function of expected earnings.

Valuation Models for Nonconvertible Industrial Bonds

Common to both of the above models for valuing a convertible bond is a variable representing the straight bond value of the convertible, $V_{(t)}$. A common model for placing a value on the convertible as a straight bond is

$$V = \sum_{t=1}^{n} \left[\frac{I}{(1 + i)^t} + \frac{F}{(1 + i)^n} \right]$$

where: V = straight bond value,

I = annual interest payments based on the coupon rate,

F = face value of the bond,

n = years to maturity, and

---

[5] Ibid., p. 39

i = market yield to maturity on a straight bond of the same company.[6]

If the i term in the above equation is redefined as, "the market yield to maturity of a straight bond of a firm in the same risk class," the formula would hold for valuing all nonconvertible bonds or the straight bond portion of all convertible bonds issued by a firm.

Key points to be made here are (1) that the value of i in the above equation is a function of both (a) the interest rate movements in the capital markets and (b) the changes in the financial risk of the company involved and (2) that the financial risk of the company is certainly a function of earnings.[7]

On an a priori level, it appears reasonable to hypothesize that the annual earnings announcements of firms with nonconvertible or convertible debt issues or both outstanding would be of interest to corporate bond investors. Straight bond investors should have an interest in the annual earnings of the firm to the extent such earnings are related to the short- and long-run solvency of the firm and its ability to meet both annual interest payments and maturity value obligations. To the extent that cash flow is a function of earnings, earnings announcements may be useful to investors in nonconvertible bonds. Convertible bond investors should display a two-pronged interest in the annual earnings announcements of the issuing firms. One interest, shared in common with holders of nonconvertible debt instruments, is in the solvency of the firm and its earning power in terms of an ability

---

[6] James C. Van Horne, Financial Management and Policy (Englewood Cliffs, New Jersey, 1974), p. 374.

[7] Ibid., pp. 374-375.

to generate the funds required to meet short- and long-term obligations of the firm. The second interest of investors in the annual earnings announcements of convertible debt issuing firms is a result of the effect of such announcements on the value of the firm's common stock and thus the value of the convertible feature of the bond. Van Horne refers to this two-pronged interest of convertible bond investors in annual earnings.

> . . .(W)hen the market price of the stock falls because of poor earnings, the company may have financial difficulty, in which case its credit standing will suffer. As a result, the straight bond value of the convertible may decline along with the decline in its conversion value, giving the investor less downside protection than he might have expected originally.[8]

In both the BMQ model and the Brigham model of the value of the convertible feature of a convertible debt issue a key variable is the market price of the common stock--$P_{(t)}$ in the BMQ model--or the rate of growth in the stock's price--g in the Brigham model--both of which are directly related to a firm's earnings.

Among the empirical evidence which exists to support the a priori reasoning that annual earnings announcements should have information value to bond investors in their assessment of risk and, therefore, should be impounded in bond prices as part of the total data set which determines bond prices is a study conducted by Horrigan.[9] In his analysis of the bond rating process Horrigan used multiple linear

---

[8] Ibid.

[9] James O. Horrigan, "The Determination of Long-Term Credit Standing with Financial Ratios," Empirical Research in Accounting: Selected Studies, 1966, Supplement to Vol. IV, Journal of Accounting Research, pp. 44-62.

regressions on the initial sample of bond ratings with various combinations of financial ratios as the independent variables. Among the five ratios included in the model were working capital to sales, sales to net worth and net operating profit to sales, all of which may be derived by investors from annual earnings announcements.[10] Based on his research Horrigan concluded, ". . .financial ratios and accounting data can be useful in long-term credit administration."[11]

Fisher has also provided some evidence that earnings are an important variable in assessing the risk class of a debt issue of a particular firm.[12] Fisher examined the explanatory power of a four-variable model with respect to the risk premium associated with a sample of industrial corporate bonds and using least-squares regressions on 366 observations produced the following model with the estimated coefficients:

$$X_o = .987 + .307X_1 - .253X_2 - .537X_3 - .275X_4$$

where: X_o = logarithm of the average bond risk premium,

X_1 = logarithm of risk surrogate earnings variability,

X_2 = logarithm of risk surrogate reliability in meeting obligations,

X_3 = logarithm of risk surrogate capital structure, and

X_4 = logarithm of risk surrogate bond marketability.[13]

---

[10] Ibid., p. 55.

[11] Ibid., p. 62, emphasis added.

[12] Lawrence Fisher, "Determinants of Risk Premium on Corporate Bonds," The Journal of Political Economy, LXVII (June, 1959), pp. 217-237.

[13] Ibid., p. 218.

Note that earnings variability--certainly a statistic based on annual earnings, past and present--is a key variable in this model of the determinants of risk premiums on corporate bonds.

The point of this reference to the Fisher model for the prediction of risk premium on corporate bonds is to provide additional a priori evidence that bond investors perceive annual earnings announcements as containing information relevant to their investment decisions. Therefore, one would expect the prices of bonds to fluctuate when annual earnings are announced. Lev in assessing the significance of Fisher's model says

> A model for the prediction of risk premium on corporate bonds may be of significant importance to the firm's financial managers as well as to investors. . . A risk premium prediction model may be used by investors and bond portfolio managers to assess the riskiness of bonds. . .[14]

Pinches and Mingo used a factor analysis method of achieving a parsimonious description of the variables which describe and predict bond ratings and, thus, are factors in assessing risk and establishing bond prices.[15] Of the thirty-five variables considered in their study, five different dimensions were identified by factor analysis as key variables. Among the five were return on investment, earnings stability and debt coverage--all related directly to earnings.[16]

Pogue and Soldofsky also analyzed the bond rating process and determined that bond ratings or assessments of risk are dependent on

---

[14]Baruch Lev, p. 158.

[15]George E. Pinches and Kent A. Mingo, "A Multivariate Analysis of Industrial Bond Ratings," The Journal of Finance, XXVIII (March, 1973), pp. 1-18.

[16]Ibid., pp. 5-6.

readily available statistics on the firm's financial condition and operations.[17] They found the five most explanatory variables in assessing risk to be leverage, earnings coverage, earnings instability, profitability, and asset size. Table II presents the arithmetic means

TABLE II

VALUES FOR EXPLANATORY VARIABLES: INDUSTRIAL BONDS, 1961 THROUGH 1966[18]

	Mean and (Standard Deviation) of Explanatory Variables[c]					
Bond Rating	X_5 Earnings Coverage (times)	X_1 Debt-Capitalization Ratio (%)	X_2 Profit Rate[a] (%)	X_3 Earnings Instability[b]	X_4 Asset Size ($ Billion)	Sample Size
Aaa	32.07 (21.60)	9.96 (3.93)	8.83 (2.88)	.228 (.182)	5.603 (3.187)	10
Aa	13.48 (7.57)	18.18 (6.70)	6.78 (2.46)	.321 (.209)	1.548 (1.389)	10
A	7.12 (1.86)	23.87 (5.54)	5.74 (1.38)	.360 (.162)	.920 (.492)	10
Baa	5.20 (1.70)	30.04 (4.83)	4.78 (1.65)	.563 (.307)	.546 (.296)	10

[a] Net income divided by total assets. Annual basis.

[b] Standard deviation of annual profitability for each company divided by mean profitability. The figures shown are pure numbers.

[c] The mean of the annual values for the individual bonds used for this industry. The standard deviation represents the dispersion of results for the individual companies.

---

[17] Thomas F. Pogue and Robert M. Soldofsky, "What's in a Bond Rating?" Journal of Financial and Quantitative Analysis (June, 1969), pp. 201-228.

[18] Ibid., p. 212.

and standard deviations for these five explanatory variables with ten industrial bonds classified in each of the top four ratings (AAA through B) issued by Moody's during 1961-1966. Notice that annual earnings is the key variable in factors X_5, X_2, and X_3.

The presentation of the above research results is not included in this study as evidence that bond investors actually include the variables referred to in their investment decision making processes. Instead, the above research efforts are referred to only as indications that investors might consider the annual earnings announcement of an industrial bond issuer as an important piece of information to be included in the total information set which determines bond values and, therefore, that the price of industrial bonds might be expected to fluctuate more than "normal" around the period of annual earnings announcement.

The Intrinsic Value Adjustment Process

The determinants of the intrinsic or true economic value of a firm include such basic factors as management capabilities, capital structure, asset configuration, and earnings. The role of new information concerning any of these fundamental factors is to allow bondholders or stock holders to adjust or modify their expectations as to future earnings streams or to modify their original assessment of the relative risk of default on interest payments and maturity value, cancellation of dividend policies, or complete financial insolvency. As future earnings expectations and risk assessments serve as information inputs into the investment models presented in the previous section, the modification of earnings expectations and risk assessments

leads to new present values for the bonds. By comparing the revised present value of the bond to the current market price the investor supposedly makes a decision to buy, sell or hold a particular security. The buy-sell-hold decisions made by investors are reflected in bond price movements and the bond price movements which are based on the new information reflect adjustment to a new intrinsic value.

Given the validity of the above described intrinsic value adjustment process, a relationship between a specific bond price change and a data input exists. If it is possible to adequately isolate the point in time that the investor becomes aware of new data, a causal relationship between a change in price and the new data may be hypothesized if the investor perceives the new data to have information value to him, i.e., data relevant to his decision processes which initiates a change in his expectations. Because bond price changes reflect the results of covert, but conscious, economic decisions by investors, the investor's assessment of the new data as being useful may be inferred if a price change is identified with a particular data input.

Portfolio Theory and Accounting Data

The portfolio theory of Markowitz is an alternative (and to some a more palatable) context within which accounting information issues may be evaluated.[19] Markowitz's model emphasizes that the relevant level

---

[19] Harry M. Markowitz, "Portfolio Selection," The Journal of Finance, XII (March, 1952), pp. 77-91. The two-parameter portfolio theory model of Markowitz, as simplified by Sharpe, may be expressed as

$$R_{it} = \alpha_i + \beta_i R_{mt} + u_{it} \qquad (1)$$

$$E(R_{it}/R_{mt}) = \alpha_i + \beta_i R_{mt} \qquad (2)$$

$$R_{it} - E(R_{it}/R_{mt}) = u_{it}. \qquad (3)$$

of concern to the individual investor is not with the individual security itself (as is the case in the intrinsic value models of the previous section) but instead is with the entire portfolio of securities held. The only level, according to portfolio theory, at which the investor should be concerned with the returns on individual securities is not with total variability of return, but only the systematic variability of the security with other securities in the portfolio. In a market model format the variance (a surrogate measure for risk) of a portfolio's return is composed of

$$\sigma^2(R_{pt}) = 1/N\ \overline{\sigma^2\ (u_{it})} + \overline{\beta}^2\ \sigma^2\ (R'_{mt})$$

where: $\sigma^2(R_{pt})$ = the variance of the portfolio's return,

N = the number of different securities comprising the portfolio, assuming equal amounts invested in each security,

$\overline{\sigma}^2(u_{it})$ = the average variance of individualistic factors, (u_{it}),

---

where: R_{it} = the return on security i in period t,

α_{it}, β_{it} = intercept and slope of linear relationship between R_{it} and R_{mt},

R_{mt} = the market index in period t,

u_{it} = stochastic portion of individualistic component of R_{it}, and

$E(\ )$ = expected value

The assertion of this model (equation (1) above) and portfolio theory is that a linear relationship exists between the expected return on security i and the expected value of a market index. Another assertion of the theory is that the expected return on security i, given the ex post value of the market index, is also a linear function of the market factor (equation (2) above). The actual return on security i (ex post) differs from the return expected given the value of the market index, by u_{it} which reflects the unexpected return on security i given the factor index. Consistent with random walk theory the expected value of u_{it} in portfolio theory is zero.

$\sigma^2(R'_{mt})$ = the variance of the market factor,

$\overline{\beta}^2$ = the average β squared where β_i = the slope of the linear relationship between the return on security i and the return on a market index, and

R'_{mt} = the market index.

The first factor, $1/N\sigma^2(u_{it})$, is the individual or nonsystematic risk (e.g., strikes, inventions, management errors, etc.) of a security which may be diversified away merely by increasing N, the number of securities in the portfolio. β reflects the unavoidable, systematic risk which is associated with more general economic, psychological, or political factors which cannot be diversified away.

The relevance of portfolio theory to this study is that if investors realize that the unsystematic risk associated with an individual security which is included in their portfolio is diversified away (or significantly reduced) by the very fact the security is part of a portfolio, security analysis may be reduced to estimating β, the prediction of the value of the systematic risk coefficient. Beaver presents a very thorough review of portfolio theory and in assessing the interrelationships between accounting data, portfolio analysis, and efficient markets states

> This sort of analysis replaces the intrinsic value approach as the major thrust of security analysis. Moreover, the role of accounting data becomes its predictive ability with respect to β.[20]

If portfolio theory is accepted as a model of appropriate investor behavior and if β, the systematic risk coefficient, is the parameter

---

[20] William H. Beaver, "The Behavior of Security Prices and Its Implications for Accounting Research (Methods)," p. 424.

investors or analysts are most concerned with predicting, what is the role of annual earnings announcements in investors or analysts making such a prediction?

It has just been demonstrated that when securities are combined in a portfolio, the specific variability of each security becomes relatively unimportant with the major contributor to the portfolio's risk being the common variability associated with general economic or market changes. That is, the coefficient β, which is an estimate of the degree to which a security's return is subject to the market or systematic variability, measures the contribution of the security to the total variance (riskiness) of the portfolio. The implications of this are (1) that the unsystematic risk associated with securities may be diversified away and, therefore, will not attract any risk premium in the market and (2) that because systematic variance cannot be diversified away and because investors are generally described as being risk adverse they will demand a risk premium (a higher return) for bearing this risk.

Given an expected value of β for a particular security the investor can be expected to make periodic (depending on the flow of relevant information to him) assessments of the β of each security in his portfolio to determine if that security continues to provide the required rate of return to compensate for the degree of risk with regard to the total portfolio that that particular security contributes. Francis and Archer present a very simple form for tabulating the probability distribution of rates of return for a security which is reproduced in Figure 1. Note that in effect this form provides a format for the process of predicting the β associated with a particular security given

The security analyst should fill in the estimated rate of return which will occur for_____company during the future period from_____ to_____for each of the four possible economic conditions. The economist should fill in the probabilities associated with each economic condition.

Economic Condition	Probability	Forecasted Rate of Return
Boom		
Slow Growth		
Zero Growth		
Recession		
	1.0	

Source: Jack C. Francis and Stephen H. Archer, Portfolio Analysis (Englewood Cliffs, New Jersey, 1971), p.55.

Figure 1. Form for Tabulating Probability Distribution of Rates of Return for a Security

four states of the economy, boom through recession. While historical data may prove to be of major significance in the prediction of the covariance of the return of a particular security with the return of a market index (especially if β is stable over time), current information regarding the return on a particular security, e.g., the annual earnings of the company--when evaluated in relation to the general economic, political, or psychological conditions which existed during the period of operation--may certainly have information value to investors, especially if the relationship varies from their expectation.

In such a situation a variant of the one-period Litner capital asset pricing model may be used to describe the processes through which bond prices may adjust for information contained in annual earnings

announcements. The Litner model asserts that an asset's value is a function of the joint distribution of dollar returns, market return, the riskless rate, and the price of risk as follows:

$$V_i = \frac{E(\tilde{Y}_i) - \lambda \, cov(\tilde{Y}_i, \tilde{r}_m)}{1 + k}$$

where: V_i = the value of asset i,

$E(\ )$ = expected value,

$\tilde{Y}_i$ = dollar returns or end of period cash flows,

λ = price of risk,

$\tilde{r}_m$ = the market return, and

k = the riskless rate of return.[21]

The above model implies that the price of a nonconvertible bond will change as a result of the announcement of information (an annual earnings announcement) specific to a firm as follows: Given a one-period bond, an annual earnings announcement may cause an upward (or downward) revision of expectations as to the level of permanent earnings. The probability of earning all dollar returns less than the contracted rate of interest and principal is reduced in the case of an upward revision of expectations and increased in the case of a downward expectations revision. But the probability of earnings higher than the contract rate is unchanged by any earnings expectations revisions, i.e., no return greater than the contracted return is possible. The change in the lower end of the return distribution--compressed if an

---

[21] John Litner, "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Markets," Review of Economics and Statistics, XLVII (February, 1965), pp. 13-37.

upward revision, extended if a downward revision--will change the expected dollar return $E(\tilde{Y}_i)$. As a result of the change in the shape of the return distribution, the variance of the distribution will also change producing a change in the covariance of expected dollar returns and the market return. Therefore, both the $\tilde{Y}_i$ and the $cov(\tilde{Y}_i, \tilde{r}_m)$ terms in the Litner model will change, and unless the changes are offsetting, the value (and therefore the price) of the bond--V_i--will also change.

To generalize the above analysis to nonconvertibles with maturity dates exceeding one period it is necessary to give consideration to secondary markets where end-of-period selling prices are not constrained to be equal to maturity value. Because dollar returns are not upper bounded by maturity values given multi-period bonds and secondary markets, it is possible that information unique to a firm might result in a shift in the location parameter $E(\tilde{Y}_i)$ of the return distribution with no change in the shape of the distribution and, therefore, no change in systematic risk. That is, the price will change only if there is a change in expected returns, $E(\tilde{Y}_I)$. However, it would appear that the closer a nonconvertible approaches maturity date the more similar to a one-period bond it will become and the more likely are changes in systematic risk accompanied by changes in bond value and price. Because secondary markets for convertible bonds would appear to always be present, the return distribution would not be upper-bounded and price changes in the absence of changes in systematic risk are clearly conceivable. A similar analysis is therefore appropriate.

Evidence Supporting the Information Content Hypothesis

Two earlier studies are particularly significant as support for the hypothesis of information content of earnings. Although several other studies also report support for the information content hypothesis, Beaver's[22] empirical study of the information content of annual earnings announcements and May's[23] study of the effect of quarterly earnings announcements on investor decisions are most relevant to this research for two reasons. First, although both of the above studies are based upon stock market research, they address the same question this study addresses, i.e., are annual earnings announcement data impounded in security prices? Second, it is the basic research methodology of Beaver as adapted by May which forms the foundation for the methodology proposed in Chapter III of this research.

Beaver examined the volume and price adjustments of common stocks to annual earnings announcements while May examined price adjustments of common stocks with regard to quarterly earnings announcements. Beaver's study was undertaken to answer charges that accounting measurement errors in calculating earnings are so large that earnings announcements are not relevant to the investment decision process and that other information sources available to investors are more timely and thus preempt the value of earnings announcements. May's study was undertaken to provide a foundation from which to recommend to

---

[22]William H. Beaver, "The Information Content of Annual Earnings Announcements," pp. 67-92.

[23]Robert G. May, pp. 119-163.

accountants and managers the efforts which should be devoted to improving quarterly earnings measurements. Therefore, both of the above studies have the assessment of the information content of earnings announcements in common with this research with the difference being that their research was conducted with stock market data and this research is conducted with bond market data.

The test statistic used by both Beaver and May was derived from the following transformation of weekly stock price changes:[24]

$$R_{it} = \ln\left[\frac{D_{it} + P_{it}}{P'_{it-1}}\right]$$

where: R_{it} = the natural logarithm of a price relative and approximates the rate of return for a security assuming continuous compounding,

D_{it} = the dividend "paid" on a share of firm i in week t,

P_{it} = closing price for share of firm i at end of week t, and

P'_{it} = closing price at end of week t-1, adjusted for capital changes (e.g., stock splits and stock dividends).

Beaver then calculated the return on the "market" in the following manner:[25]

$$R_{Mt} = \ln\left[\frac{(SP)_t}{(SP)_{t-1}}\right]$$

where R_{Mt} = the natural logarithm of a price relative and approximates a hypothetical rate of return on a market portfolio assuming continuous compounding,

$(SP)_t$ = closing value of Standard and Poor's Price Index at end of week t, and

---

[24]William H. Beaver, "The Information Content of Annual Earnings Announcements," p. 73.

[25]Ibid.

$(SP)_{t-1}$ = closing value at end of week t-1.

Next he used the simple linear regression model

$$R_{it} = a_i + b_i R_{Mt} + u_{it}$$

where: R_{it} and R_{Mt} are as defined above,

a_i and b_i = estimations of the intercept and slope of linear relationship between R_{it} and R_{Mt} and

u_{it} = the portion of security i's return in period t which cannot be explained by general market factors[26]

to arrive at an estimate of the general market effect on each security's return in order to isolate the return which could be identified as unique to security i. The unique portion of the return during a particular report week was then determined as follows:[27]

$$u_{jt} = R_{jt} - a_i - b_i R_{Mt}$$

where: i = index number of the firm; i = 1. . .143

j = index of the earnings announcement; j = 1. . .506

t = index of time t = -8 to t = +8, where week zero is the week of the earnings announcement.

To abstract from the positive and negative signs of u_{jt}, Beaver squared u_{jt} in arriving at his test statistic.[28]

---

[26] Ibid., p. 78.

[27] Ibid., p. 81.

[28] Ibid., p. 79. Because this process of squaring the u_{it} before averaging across firms and time periods gives greater weight to large residuals than to small residuals and thus possibly introduces a bias towards rejecting the null hypothesis of no information content, the methodology described in Chapter III uses the absolute value of u_{it} instead of u_{it}^2. See Robert G. May, "The Influence of Quarterly Earnings Announcements on Investor Decisions as Reflected in Common Stock Price Changes," Empirical Research in Accounting: Selected Studies, 1971, Supplement to Vol. IX, Journal of Accounting Research, p. 135,

The next step in the Beaver methodology as adapted by May was to calculate $|\bar{u}_{it}|$ the average value of the absolute value of u_{it} in non-report periods for each firm in the sample. Finally, the ratio $|u_{it}| \div |\bar{u}_{it}|$ was computed for each report period week for each firm in the sample. The above ratio, referred to as U^*_{it}, was considered a random variable for which observations were gathered over a sample of firms. The ratio measures for each firm the average relationship between the price change in the week of the earnings announcement and the average weekly price change that the firm experiences throughout the study period and has an expected value conditional upon no information content associated with the earnings announcement of unity.[29] The basic research hypothesis of both the May and Beaver studies was if the earnings announcements (quarterly or annual) had information value to investors and, therefore, changed the expectations of investors as to future returns or risks, this would be evidenced by greater than normal changes in prices during the earnings announcement period. In terms of their test statistic, the research hypotheses of May and Beaver are that during the earnings announcement week the ratio U^*_{it} is significantly greater than 1.0. Based on the anlysis of their separate results May and Beaver concluded that the behavior of price changes supports the hypotheses that annual (Beaver) and quarterly (May) earnings reports contain information for investors.[30]

---

for a comment regarding using absolute values of u_{it} instead of u^2_{it} to minimize the effects on average u_{it} of a possible few large price change responses occurring in weeks of earnings announcements.

[29] Ibid., pp. 135-136.

[30] William H. Beaver, "The Information Content of Annual Earnings Announcements," p. 82 and Robert G. May, p. 150.

The Beaver and May studies are significant for three reasons. First, both provide evidence that stock market investors do adjust their investment portfolios as the result of information inputs; second, the adjustment of the stock prices to the new information is rapid and, therefore, demonstrates that the stock market is reasonably efficient; and third and most significant to this research, the studies of Beaver and May suggest that information inputs and the subsequent price changes can be isolated and inferences drawn about the information content of accounting data.

Because the Beaver and the May studies were conducted in the stock markets, in which considerable research had been conducted, it is obvious that care should be exercised in adapting their methodologies to bond market research where precedents are much less numerous or convincing. However, use of the Sharpe-Lintner market model,

$$R_{it} = \alpha_i + \beta_i R_{Mt} + u_{it}$$

where all variables have been defined above, is not without precedent. For example, Walter and Que, in a study of the specific influence of the so-called "bond floor" upon the risk premiums associated with convertible bonds, used the market model with bond market data.[31] While for their purposes the market model was less than ideal due to the changing relationship between conversion values and straight bond values, the authors appear to have considered the model adequate enough to conclude

> Notwithstanding the limitations of the market model, the conclusion seems inescapable that--in the case where

---

[31] James E. Walter and Agustin V. Que, "The Valuation of Convertible Bonds," The Journal of Finance, XXVIII (June, 1973), pp. 713-732.

> conversion values equal or exceed straight bond values--the bond floor contributes less to the worth of the convertible bond than is normally believed.[32]

Ang and Balcha in a study to test the efficiency of the bond market with respect to "bond swap profitability" also utilize the market model in conjunction with bond market data.[33]

An efficient capital market is one in which security prices always reflect fully some set of information concerning the firm issuing the traded security. Such a security market is efficient in the sense that it properly fulfills the primary role of a capital market--the optimal allocation of resources. Among the implications of capital market efficiency are (1) securities prices will adjust rapidly and in an unbiased manner to new information, over time as a random walk, i.e., in a patternless manner.[34]

The significance of the random walk and efficient capital market hypotheses to this research lie in their use as a justification for a methodology to detect the hypothesized investor impounding of information, specifically annual earnings announcements, in bond prices. Ball and Brown recognize the importance of these theories in an article previously reviewed.[35]

> Recent developments in capital theory provide justification for selecting the behavior of security prices as an operational

---

[32] Ibid., p. 729.

[33] James S. Ang and Dembel Balcha, "On Bond Swap Profitability," (unpublished paper, Oklahoma State University, 1974, forthcoming in The Journal of Finance).

[34] Eugene F. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," pp. 383-417.

[35] Ray Ball and Philip Brown, pp. 159-78.

> test of usefulness (of accounting income numbers). An impressive body of theory supports the proposition that capital markets are both efficient and unbiased in that if information is useful in forming capital asset prices, then the market will adjust asset prices to that information quickly. . .(and) changes in security prices will reflect the flow of information to the market. An observed revision of stock prices associated with the release of the income report would thus provide evidence that the information reflected in income numbers is useful.[36]

Although the existing evidence regarding bond market efficiency is inconclusive--primarily due to a lack of sufficient empirical research with bond market data--evidence does exist to support a claim that the bond market is efficient, i.e., fully reflects in bond prices all publicly available information concerning the firms which have issued these securities.[37] In their previously referred to study to test the

---

[36] Ibid., pp. 160-161.

[37] See the following article regarding possible evidence that the bond market is not efficient: Steven Katz, "The Price Adjustment Process of Bonds to Rating Reclassifications: A Test of Bond Market Efficiency," The Journal of Finance, XXIX (May, 1974), pp. 551-559. It is important, however, to also note the comment of Andrews regarding Katz's conclusion that the bond market is inefficient. Victor L. Andrews, "Discussion: The Price Adjustment Process of Bonds to Rating Reclassifications: A Test of Bond Market Efficiency," The Journal of Finance, XXIX (May, 1974), pp. 560-561. Professor Andrews notes

> Professor Katz concludes that there is no market anticipation of the economic and financial realities underlying a rating change...but in a footnote offers the comment that 'The lag (in price adjustment) might be due in part to nominal prices not fully reflecting real prices.' In a bond market populated on the funds supply side by institutional holders with little trading propensity there is a good question about how "real" market prices really are. . . .(T)his raises a question as to whether or not it is the rating that is being priced rather than the risk of a bond issue. That is, if institutional holders trade little in any event and mostly hold to maturity, it may be that the reality for them short of actual default is the rating attached to a bond rather than its cash flow coverage. For portfolio evaluation purposes in regulatory contexts the reality could be the rating rather than prospectively remote possibilities of default. If this is the case, the market reaction may be timely and the market not nearly as inefficient as Professor Katz concludes. (Emphasis added.)

efficiency of the bond market Ang and Balcha report that the results confirm the ability of the bond market to adjust quickly to information

> . . .due mainly to the existence of informed bond traders. The efficiency of the bond market is expected since there is no a priori reason not to expect it to be as efficient as the stock market.[38]

The assumption of bond market efficiency is crucial to this study. If market efficiency (rapid adjustment to new information) cannot be established as an accurate description of the bond market, it is not possible to isolate a particular price change as attributable to any specific piece of publicly available information. If, in fact, the bond market is inefficient (does not react rapidly to new information) a particular price change may be the result of some unspecified occurrence in some unspecified earlier time period and not necessarily attributable to an annual earnings announcement in the same period as the price change.

Another piece of research which provides some evidence that the bond market is efficient is a study conducted by Baskin and Crooch.[39] They found that the same factors affect rates of return on flat bonds and those of common stocks and, in fact, there was a high degree of correlation between the historical rates of return earned on flat bonds and those of common stocks.[40] This finding implies that bond investors are aware of available returns from other possible investments (news

---

[38]James S. Ang and Dembel Balcha.

[39]Elba F. Baskin and Gary M. Crooch, "Historical Rates of Return on Investments in Flat Bonds," Financial Analysts Journal, XXIV (November-December, 1968) pp. 95-97.

[40]Ibid., p. 97.

or data) and impound that information in flat bond prices which in turn dictate the rates of return to be earned on flat bonds. To the extent that flat bond investors are typical of general bond investors--they appear to have in common a desire for a known maturity value of their security as opposed to the risk associated with unknown "ultimate" values of common stocks.

Summary

This chapter discusses the theoretical foundations upon which the methodology described in Chapter III is based. Two alternative models of investor behavior (the intrinsic value models and the portfolio theory model) have been presented and an examination of price adjustments as a result of investors' adjustments of their expectations discussed. Then, a causal relationship between information inputs (annual earnings announcements) and price response was hypothesized, and empirical evidence which supports this hypothesis and the methodology described in Chapter III cited. Finally, the significance of bond market efficiency to this study was acknowledged and evidence to support such efficiency discussed.

CHAPTER III

HYPOTHESIS AND METHODOLOGY

Introduction

This chapter includes a presentation of the hypothesis to be tested and the methodology to be used in testing the hypothesis. The hypothesis to be tested concerns the information content of annual earnings announcements as perceived by corporate bond investors. Included in the discussion of the methodological structure of this research are a definition of the information stimuli and its source, identification of the population of firms under study, definition of sample selection criteria and procedures, and the development of the test statistic used to estimate the population parameter. Also included are discussions of the data sources used and the limitations of the methodology.

Research Hypothesis

Research dealing with the information value or content of corporate earnings announcements in an efficient capital market context has been conducted in the stock markets. In research previously cited

Beaver,[1] Ball and Brown,[2] and May[3] were able to conclude that common stock investors appear to impound the "news" included in an earnings announcement in their investment decision information sets. Specifically, earnings announcements appear to contain information which changes common stock investors' expectations. This research is conducted to determine if the same is true of corporate bond investors.

The earnings announcements which are the information stimuli in this research are the short summaries of financial data such as yearly sales and earnings which appear in the financial press. These statistics will subsequently be reported in more detail along with additional financial and non-financial data in the annual reports issued to stockholders and other interested parties. But, the first earnings announcement which is an accurate and reliable (within the constraints of human error) presentation of the independently attested to results of operations for the year is the brief summary of sales, net income and earnings per share which appears in The Wall Street Journal under a column headed "Digest of Earnings Reports." As this is the first public exposure given to the earnings figure which will appear in the annual reports, it is assumed that it is the earliest source of information regarding annual earnings available to bond investors. This, of course, does not mean that prior to its appearance in The Wall Street Journal other information regarding earnings is not publicly available.

---

[1]William H. Beaver, "The Information Content of Annual Earnings Announcements," pp. 67-92.

[2]Ray Ball and Philip Brown. pp. 159-178.

[3]Robert G. May, pp. 119-163.

A majority of firms which are publicly held issue quarterly earnings announcements which would be of value to investors in forming their expectations of annual results of operations. It is also not at all uncommon for firms' executives to make public estimates of annual earnings both before the end of the financial year and in the interim period between the end of the financial year and the appearance of the earnings announcement in The Wall Street Journal. Still another source of information relating to the expected earnings of a publicly held firm is the projections of professional analysts who make their estimates publicly available through the financial press or brokerage house newsletters. Therefore, the appearance of an annual earnings announcement in the financial press is not the original or sole source of such information available to investors. In fact, there is such a sizeable and diverse amount of such information available to investors before the appearance of the independently attested to earnings figure that some have challenged the value to investors of such earnings announcements.[4]

It is not the purpose of this research, however to measure the importance of annual earnings announcements relative to the value of all of the alternative, and perhaps more timely, sources of information available to bond market investors. The objective of this study is to provide evidence that bond investors do or do not utilize earnings announcements in their investment decisions and that, therefore, earnings announcements contain or do not contain sufficient information to change the expectations of these investors.

---

[4]Baruch Lev, Financial Statement Analysis: A New Approach, p.227.

The objective of this study is to be accomplished by identifying the period (two weeks) during which a firm's annual earnings announcement appears in The Wall Street Journal and observing the market price changes of that firm's publicly held bonds immediately preceding, during, and after the annual earnings announcement. If these annual earnings announcements lead to subsequent changes in bond investors' expectations regarding the firm's future operations, it is hypothesized that the change in bond prices in the announcement period will be greater than the "normal" change in bond prices.

The principal hypothesis of this research is:

Null Hypothesis, H_o: The annual earnings announcements of corporate bond issuers do not have information value to corporate bond investors.

Alternative Hypothesis, H_a: The annual earnings announcements of corporate bond issuers do have information value to corporate bond investors.

Identification of the Universe and Samples

Universe Criteria

The universe of bond issues considered in this research included those issues which met the following criteria:

1. Listed in the December, 1972, Bond Guide as issued in 1967 or earlier and outstanding as of December 31, 1972;[5]
2. Listed on the New York Bond Exchange (NYBE);

---

[5] Bond Guide, Vol. 36 (New York, December, 1972).

3. Issued by firms not included in the following Standard and Poor's industry classifications:

    a. Banking,
    b. Finance,
    c. Insurance,
    d. Railroads,
    e. Real estate investment trusts,
    f. Telecommunications,
    g. Utilities -- Electric,
    -- Gas,
    -- Water,
    -- Diversified;

4. Issued by firms which continued from 1968 to 1972 to issue earnings announcements as separate and identifiable entities, i.e., firms which have not lost their corporate identity due to merger and consolidation.

The criterion of being outstanding from 1967 or earlier through December 31, 1972, assured that any bond issue selected in the sample was outstanding for at least the five-year period selected as the period of analysis. The five-year period was selected as a span of time long enough to provide data not unduly influenced by short-term economic, political, or psychological influences on the bond market, and short enough to be feasible in terms of data collection and handling, and current enough to be relevant.

The second criterion--listing on the NYBE--facilitated data collection without significantly restricting the size of the universe. Based on bond sales data for the year January 1, through December 31, 1972, excluding bonds listed on the American Bond Exchange (ABE) reduced the population by only approximately 12 percent.[6]

---

[6]Of total bond sales of $6,172,613,100 on the NYBE and the ABE, in 1972 only $728,496,000 or 11.8 percent were sold on the ABE. The Wall Street Journal, January 2, 1973, pp. 22, 32.

Bond issues of firms classified by Standard & Poor's Corporation in the industries enumerated in the third criteria were excluded from the universe to provide a more homogeneous group of firms for this study and to eliminate some possible experimental control problems. In general, the industries which were excluded from this study were regulated industries and, therefore, subject to influences difficult to control for in the experimental design utilized.

The condition that the issuing firm was not acquired by and consolidated as a subsidiary of another firm during the five-year period under study assures that annual earnings announcement dates may be identified for all bond issues in the study. And bond issue price changes, if any, may be directly associated with earnings announcements of firms responsible for meeting the interest payments and retiring the debt associated with the specific bond issue. In the case of bond issues of firms whose financial statements are consolidated with other firms' statements, it is difficult to attribute a bond issue price change to a "consolidated" earnings announcement. Consolidated earnings represent in many cases the combined results of operations of several firms in diverse industries. Because the consolidated entity is not necessarily the legal entity responsible for the debt, it is difficult to specify a direct link between the earnings announcement of the consolidated entity and the price of a bond issue of a particular firm in the consolidated entity. For this reason, bond issues of consolidated firms were excluded from the universe.

Only one bond issue per issuing firm was included in the sample to avoid allowing any one firm's issues an undue influence on this research. Where more than one debt issue of a firm meets the criteria

established for inclusion in the sample, the particular issue included was selected randomly.

Sample Selection Criteria and Procedures

The following sample selection criteria were met by the bond issues which were included in this study:

1. Over the complete five-year period (which includes 131 bi-weekly periods) no more than 12 bi-weekly prices are not quoted for each issue included; prices must be quoted for at least 119 bi-weekly periods;
2. In any one year of the five years no more than five prices may be missing;
3. No bond issue is included in the study if a price is not quoted for that security in a period during which the firm's annual earnings announcement appears in The Wall Street Journal;
4. No bond issue is included in the sample if it is determined that during the earnings announcement period significant news relating to that firm is reported in the financial press.

Table III summarizes the impact of the sample selection criteria on the universe which lead to a sample size of 85 bond issues.

Bond price quotations as of the end of each of 131 two-week periods were collected from Barron's for each bond issue included in this research. Because being traded within a one-week period was a prerequisite for the price of a particular bond issue being quoted in Barron's and because many bond issues are not traded that frequently,

many bond issues in the universe were excluded from the sample. In fact, as presented in Table III, this was the predominant cause of elimination of an issue from the sample.

TABLE III

UNIVERSE SIZE AND THE FACTORS REDUCING THE UNIVERSE TO THE SAMPLE

	Number of Bond Issues
Universe of Bond Issues Meeting Universe Criteria	368
Bond Issues Excluded from Sample Because More than 12 Bi-Weekly Price Quotations Are Not Quoted in Barron's	262
Bond Issues Excluded Because a Price is Not Quoted in the Period of Earnings Announcement	10
Bond Issues of Firms Which are Consolidated as a Subsidiary	5
Bond Issues of Firms Making a Significant News Announcement During the Period of Earnings Announcement	6
Bond Issues Included in the Sample (See Appendix A)	85
Total	368

In the sample of eighty-five bonds analyzed in this study, a total of 11,135 (85 firms x 131 bi-weekly periods) bi-weekly price quotations are required. In the sample, however, 259 bi-weekly prices were not quoted in Barron's. To keep the experimental error as low as possible and still maintain a sample size large enough to be representative, the price quoted for the week immediately preceding the end of the two-week period for which a price quotation was missing was substituted for the missing price quotation. Because bond price changes are assumed to be a martingale, as described later, the latest price is an unbiased estimate of the next price. After this procedure was completed only 52 bi-weekly price quotations were missing and these were substituted for by using the price quoted at the end of the bi-weekly period prior to the missing price quotation. Table IV summarizes the extent of price substitution in the sample and Table V presents an analysis of the significance of the number of periods for which bond prices were not quoted in Barron's relative to the total data set.

Formulation of the Test Statistic

Logarithmic Price Relative

Chapter II included a discussion of theoretical considerations which imply an association between information available to the bond investing public and bond price movements. It was suggested that bond price movements which reflect the economic buy-hold-sell decisions of bond investors may be used to draw inferences about the information value to investors of data included in the annual earnings announcements of firms with publicly held debt securities. The price response measure utilized in this study was the natural logarithm of the bi-weekly price

TABLE IV

FREQUENCY DISTRIBUTION OF BI-WEEKLY BOND PRICE QUOTATIONS NOT QUOTED IN BARRON'S

Number of Two-Week Periods with No Bond Price Quoted at End of Second Week	Before Substitution of Prior Week's Price	After Substitution of Prior Week's Price
0	26	59
1	18	11
2	10	7
3	5	5
4	4	3
5	3	0
6	2	0
7	2	0
8	3	0
9	5	0
10	0	0
11	3	0
12	4	0
Total Number of Bond Issues	85	85

TABLE V

SUMMARY ANALYSIS OF PERIODS FOR WHICH BOND PRICE QUOTATIONS ARE NOT AVAILABLE IN BARRON'S

	Number	Percent
Total bi-weekly bond price quotes possible (85 issues times 131 periods per issue)	11,135	100 %
Total bi-weekly bond price quotes available in Barron's	10,876	97.7%
Missing bi-weekly bond prices	259	2.3%
Missing bi-weekly bond prices after substituting price quoted for previous week, i.e., requiring additional substitution	52	0.5%

change. The logarithmic price relative may be expressed as:

$$PR_{it} = \ln \left[\frac{I_i + P_{it}}{P_{it-1}} \right]$$

where: PR_{it} = the natural logarithm of the price relative of the i^{th} firm's bond at time t,

ln = the natural logarithm,

I_i = the interest earned during one bi-weekly period on the i^{th} firm's bond issue;

P_{it} = the latest price quoted for the i^{th} firm's bond issue during the bi-weekly period t, and

P_{it-1} = the latest price quoted for the i^{th} firm's bond issue during the bi-weekly period t-1.

PR_{it}, the logarithmic price relative, is a measure of the price change of a particular bond issue of a firm. It is the rate of return for the two-week period assuming continuous compounding.

Because all of the bonds which were included in the sample are interest bearing bonds and because interest accrues with the passage of time, I_i represents a constant calculated for each firm. The I_i calculation was performed as follows:

$$I_i = \frac{CR_i(\$1000)}{26}$$

where: I_i = the interest accrued during a bi-weekly period on the bond issue of firm i included in this study,

CR_i = the contract rate of interest on the bond issue of security i included in this study,

\$1000 = the face value of one bond, and

26 = the number of bi-weekly periods in one year.

This substitution of interest accrued into the logarithmic price relative is only a minor modification of the model used so extensively in the previously cited literature regarding stock market efficiency with respect to accounting data.

Removal of the General Market Effect From the Logarithmic Price Relative

The logarithmic price relative as described above reflects price changes which result from investor consideration of factors unique to each firm, factors relating to specific industries, and factors related to general, economy-wide conditions. In an often cited article, King has reported that general economic conditions (the "market effect") are a significant factor in the variance of stock price changes and the industry factor is less significant in explaining stock price changes.[7]

Industry Factor. King found that during the latest period in his study the market effect accounted for approximately thirty-one (31) percent of the total variance of common stock price changes and the industry effect accounted for approximately eleven (11) percent of such variance.[8] An ordinary least-squares model has been employed in other empirical works to eliminate the general market effect from price changes; and the industry effect, due to its relative insignificance, has not been removed.[9]

---

[7] Benjamin F. King, "Market and Industry Factors in Stock Price Behavior," Journal of Business, XXXIX (Special Supplement January, 1966), pp. 139-190.

[8] Ibid., p. 151 and 156. Meyers in a re-examination of factors in stock price behavior concludes that King overstated the role of industry factors in the market as a whole. Stephen L. Meyers, "A Re-examination of the Market and Industry Factors in Stock Price Behavior," The Journal of Finance, XXVIII (June, 1973), p. 704.

[9] For example: William H. Beaver, "The Information Content of Annual Earnings Announcements;" Eugene F. Fama, et al., "The Adjustment of Stock Prices to New Information," International Economic Review, X (February, 1969), pp. 1-21; and Raymond Ball and Philip Brown, "An Empirical Evaluation of Accounting Income Numbers."

King's study was conducted with common stock data, and, therefore, cannot be considered necessarily indicative of the relative importance of market and industry factors in explaining corporate bond price changes. To assess the importance of the market and industry factors in bond market price changes the logarithmic price relatives for the bond issues in the sample are analyzed by factor analysis.[10] The resulting variance of individual bond prices that is explained by the first five principal components in order of their contributions is presented in Table VI.

TABLE VI

PROPORTION OF BOND PRICE VARIANCE EXPLAINED BY THE FIRST FIVE PRINCIPAL COMPONENTS

	Principal Component				
	1	2	3	4	5
Proportion of Price Variance	24.10%	6.15%	3.61%	3.19%	2.99%

The first factor, which is interpreted as being the effect of general market information on bond prices, accounts for twenty-four percent of the variance in the prices of the bonds included in the

[10]The computer program utilized for this analysis was BMD03M, Factor Analysis, version of May 2, 1966. This program was developed at the Health Sciences Computing Facility, UCLA. The facility is sponsored by NIH Special Research Resources Grant RR-3.

sample. Although derived from an analysis of bond price changes and not from stock price changes, as was the case in King's study, the twenty-four percent appears reasonable in comparison. King reported a market factor of thirty-one percent in the last period of his analysis and reported that, ". . .the influence of a general market comovement effect on the stock market seems to have diminished over the years."[11] This study is conducted with data from seven to twelve years subsequent to the data used in King's research and this difference in time of examination may account for some of the difference in the magnitude of the market effect. Of course, it is dangerous to make such a comparison of bond and stock market derived statistics, but if that danger is considered, such a comparison seems legitimate as a rough test of reasonableness.

As can be noted from Table VI, the second principal component accounts for approximately six percent of total bond price variance. Based on an analysis of the factor loadings on the second principal component it appears that this factor is a surrogate for the convertible-nonconvertible feature of the bonds included in the sample. This second principal component can be used to correctly classify eighty-eight percent of the bonds in the sample as convertible or nonconvertible by stratifying on the basis of the second principal component.

None of the principal components which account for over three percent of the bond price variance could be identified as an industry factor. No grouping of firms in the same industry as defined by two-, three-, or four-digit Standard Industrial Classification codes could be

---

[11] King, p. 151.

identified by examining the factor loadings of the firms in this research. If there was an industry effect on bond price variance, it must account for less than three percent of the variance in bond prices. At such a low proportion of total variance (less than three percent) such a factor is assumed to be insignificant.

Based on this failure to detect an industry factor as a significant contributor to total bond price variance, no industry variable was included in the regression model used to determine the portion of bond price changes variance which is unique to a particular firm.

The ordinary least squares regression model used to determine and remove the general market effect from bond price relatives was:

$$PR_{it} = \alpha_i + \beta_i R_{Mt} + u_{it}$$

where:

PR_{it} = the natural logarithm of the price relative of the i^{th} bond issue at time t,

α_i and β_i = parameters unique to each bond issue which relate bond price changes to market index changes,

R_{Mt} = the natural logarithm of a market index price relative at time t,

u_{it} = the random disturbance term unique to bond issue i in time period t.

The Market Index. A bond market index based on the total bond market is not practical to compute and report as a daily financial market's statistic and none is available. To be effective as an index of the general market effect of a change in bond price relatives, an index should be representative of all issues in the universe of bonds under analysis. If the market index which is utilized in the regression model is not representative, it may bias the removal of market

related effects from price relatives. Initially, research interest centered on the Dow Jones Index of industrial bond prices for use in the regression model.

The Dow Jones Index as of December, 1972 consisted of the ten bond issues presented in Table VII. It appears that this index is composed of bonds not necessarily representative of the bond market.

TABLE VII

COMPOSITION OF THE DOW JONES INDUSTRIAL BOND INDEX AS OF DECEMBER 1972

Issuing Firm	Type of Issue	Interest Rate
Bethlehem Steel Crop.	Income	2 3/4
Dow Chemical	Debenture	4.35
General Motors Acceptance Corp.	Debenture	4 1/2
Inland Steel Corp.	Income	3.20
National Cash Register	Debenture	4 3/8
National Dairy Products	Debenture	2 3/4
Shell Union Oil	Debenture	2 1/2
Socony Mobil Oil	Debenture	4 1/4
Standard Oil Company (N.J.)	Debenture	2 3/4
Weyerhaeuser	Debenture	5.20

Source: F. L. Garcia, (ed.), Glenn G. Munn's Encyclopedia of Banking and Finance (Seventh Edition; Boston, 1973), p. 281.

All of the issues in the industrial index are large issues of major firms and appear to be issues most likely to be frequently traded.

Although frequent trading may be a logical criteria for the selection of a bond as part of a market index which is to be constructed and reported daily as a bond market summary statistic, such an index is not necessarily representative of the market or the sample of bonds selected for this research.

As a test of the reliability for the purpose of this research of the Dow Jones Index (DJI) of ten industrial bonds, a special index was constructed from the logarithmic price relatives of the bonds included in this study.[12] An effective index should be a set of weights to apply to bond returns such that an aggregation of the results explains more across-firm (market) return variance than any other set of weights. The first principal component derived from factor analysis is exactly that, i.e., a set of weights which, when applied to various security returns, produces a score which is most explanatory of the overall variance of returns.

If the DJI is representative of the bonds included in the research sample, there should be a high degree of positive correlation between the DJI and the constructed index. An analysis of the two indices indicated that the coefficient of correlation between the two is approximately 0.6 (0.596). Although this correlation coefficient implies a positive correlation of the two indices, the relationship is not as strong as might be expected. Therefore, the constructed factor analysis index was substituted for the DJI in the model to remove the general market effect from the logarithmic price relative.

---

[12] See Appendix B for a description of the procedure used to derive from the BMD03M program output an index based on the bond issues in the sample.

Several factors tend to justify the use of the constructed index instead of the DJI of ten industrial bonds. First, the DJI is composed of only ten bonds. Although it is possible that under certain conditions an index based on such a small sample could be representative of the market, it is unlikely. It is proposed that the constructed index utilized in this research is more representative of the bond issues in the sample than is the DJI. This is true by definition since the constructed index is derived from data collected from issues randomly selected from the universe.

Second, a review of the bond issues which comprise the DJI indicates that the index consists of issues of some of the most actively traded bond issues. While this may be desirable from the viewpoint of those who must construct and report an index on a daily basis, it does not necessarily result in an index which is representative of the entire population of industrial bonds or the sample of bonds included in this research. The sample of bond issues included in this study is also biased toward those issues which are frequently traded. But the bias is probably not as strong as the bias in the selection of ten industrial issues to be used in the construction of the DJI.

A third factor in the decision to adopt the constructed index is the fact that six of the ten issues in the DJI index are either also in the sample or issued by a firm with a different bond issue in the sample. Because of the bias this might introduce into the model to remove general market effects from individual bond issue price relatives and the two factors cited above, the constructed index of market effects was used in the model.

Ideally the constructed index should not include in the data from which it is prepared data pertaining to the bond issue which is to be analyzed with the index. In other words, a separate index should be prepared for each bond issue in the sample using only data from the other bond issues in the sample. Constructing such an index for each bond issue is a rather expensive and time-consuming task, however, and is not considered feasible in this study. With a sample of eighty-five bond issues any one issue represents only approximately 1.2% of the total sample. The probability that significant bias will result from failure to construct a unique index for each bond issue of the study was considered to be so small that the cost and time required to construct multiple indices could not be justified.

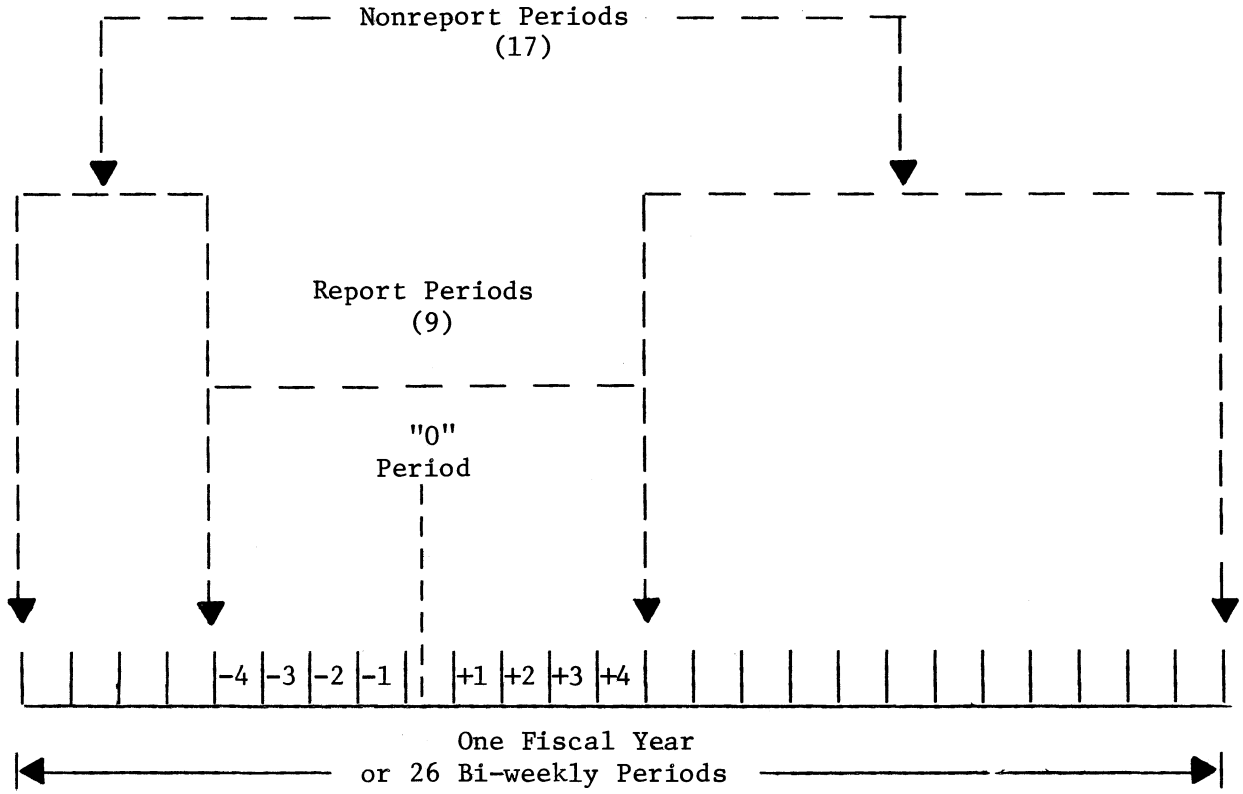
Estimating α_i and β_i. As previously noted, the ordinary least-squares regression model was to estimate the parameters α and β unique to each bond issue and which relate individual bond returns to an index of bond returns. The regression model,

$$PR_{it} = \alpha_i + \beta_i \, FAI_t + u_{it}$$

where:

FAI_t = the index of across-firm market return variance developed through factor analysis, and the other terms are as previously defined,

utilizes bond and market return data from eighty-five two-week periods. These estimates of α_i and β_i are estimates based on data from the same five years from which the earnings announcement period data to be analyzed is collected. Figure 2 is an illustration of how the twenty-six bi-weekly periods in a typical fiscal year were designated as report and nonreport periods for the purposes of estimating the α and β parameters and analyzing price relatives during earnings report periods.



"0" Period -- Bi-weekly period during which a firm's annual earnings announcement appears in The Wall Street Journal

Figure 2. Illustration of Division of One Fiscal Year Into Report and Nonreport Periods

For each of the five years included in this study the report period included the nine bi-weekly periods starting four bi-weekly periods before through four bi-weekly periods following the bi-weekly period during which annual earnings of the firm are announced. The remaining seventeen bi-weekly periods in the "typical" fiscal year were designated as nonreport periods. With five years included in the study this procedure allowed the estimates of the α_i and β_i parameters for each firm to be based on eighty-five nonreport period observations (17 nonreport periods per year for 5 years).

The relationship of any bond's return to an index of market returns is not necessarily stationary over time. Therefore, the above described procedure for estimating the parameters of such a relationship, α_i and β_i, was considered preferable to basing these estimates on data from years preceding the five years of analysis. If α and β are not stable over time, the latter procedure will likely result in biased, inefficient, or both, estimates of these parameters.

Estimating Return Unique to Each Bond Issue. Assuming -- as concluded above-- that the industry factor is not a significant source of bond return variance, the portion of bond return variance which is not due to factors unique to an issue may be removed from the total return on an issue in a particular time period with the following model:

$$\hat{u}_{it} = PR_{it} - (\hat{\alpha}_i + \hat{\beta}_i FAI_t)$$

where:

$\hat{u}_{it}$ = an estimate of the presumed effect on the return on bond issue i in period t of factors unique to firm i,

PR_{it} = the natural logarithm of the price relative (the return) on bond issue i during time period t,

$\hat{\alpha}_i$ and $\hat{\beta}_i$ = estimates of the parameters, α_i and β_i for bond i of firm i, (These estimates are the result of the regression equation presented above.)

FAI_t = the factor analysis constructed index of bond market returns in time period t, and

t = each of the bi-weekly time periods in the study.

An assumption of this research is that $\hat{u}_{it}$ is an estimate of the effect on the return on bond i during time period t of all unique factors pertaining to firm i which are public information. This is an assumption of the semi-strong test of market efficiency as described by Beaver[13] and Fama.[14]

If the hypothesis of this research is confirmed, the $\hat{u}_i$, an estimate of return on bond i -- exclusive of a market effect -- in the period of annual earnings announcement will exceed the $\hat{u}_i$ in "normal" or non-announcement periods. To test this hypothesis a standard against which to measure the $\hat{u}_i$ of bi-weekly periods identified as earnings announcement periods must be designated. Because the objective of this study did not concern the direction of the investor-determined bond-price reactions to announced earnings but was concerned only with the relative size of $\hat{u}_{it}$ in earnings announcement periods as compared to non-announcement periods, the standard against which the $\hat{u}_{it}$ of earnings announcement periods was measured was the average

---

[13]Beaver, "The Behavior of Security Prices and Its Implications for Accounting Research (Methods)," pp. 407-437.

[14]Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," pp. 383-417.

absolute value of the $\hat{u}_{it}$ terms in nonreport periods.[15] The standard against which each bond issue's report period residual terms were compared was calculated for each firm as follows:

$$\overline{|\hat{u}_i|} = 1/n \sum_{t-1}^{n} |\hat{u}_{it}|$$

where:

n = the number of nonreport periods in the five years of analysis, eighty-five

$|\hat{u}_{it}|$ = the absolute value of the residual term in nonreport period t for bond issue i, and

$\overline{|\hat{u}_i|}$ = the average or mean value of the nonreport residual for firm i.

With an estimation of the average or "normal" residual to be used as a standard against which to measure report period residuals the comparison of report to nonreport residuals was accomplished by computing a ratio for each bi-weekly period in the report period (nine bi-weekly periods in each of five years) as follows:

$$U_{it} = \frac{|u_{it}|}{\overline{|\hat{u}_i|}}$$

where:

$\overline{|\hat{u}_i|}$ and $|\hat{u}_{it}|$ have been previously defined and

U_{it} = the ratio of the mean nonreport residual to the report period residual for bi-weekly period t for bond issue i.

Computing the U_{it} ratio for each of the 9 bi-weekly report periods for each of the 85 bond issues in the sample over 5 years resulted in

---

[15] Beaver abstracted from the sign of the residual by squaring the residual, but as May points out in his study of quarterly earnings announcements, the method of squaring the residual exaggerates the effects on average measurements of a few large price changes. Since squaring gives disproportional weight to size, Beaver's method is not considered appropriate and May's method of converting to the absolute value of $\hat{u}_{it}$ is adopted. May, pp. 135-136.

425 observations per report period. The next, and final, step in computing the test statistic for each bi-weekly period in the report period was to determine across years and across firms the average U_{it} for each of the nine bi-weekly periods in report period. The hypothesis of this research could be supported if the residual term from the period of earnings announcement exceeded the mean residual term during nonreport periods. If this is the case, the mean U_{it} ratio, $\overline{U}_{it}$, is significantly greater than one. Stated quantitatively, the null hypothesis of this research was,

> H_o: The mean ratio of residuals in periods during which annual earnings are announced to residuals in nonreport periods is equal to unity, i.e., H_o: $\overline{U}_t = 1.0$.

The alternative hypothesis was:

> H_a: The mean ratio of residuals in earnings announcement periods to residuals in nonreport periods is greater than unity, i.e., H_a: $\overline{U}_t > 1.0$.

Statistical Test of Significance. To test the significance of the difference between $\overline{U}_t$ and 1.0 the "z test" was applied to the sample mean of the residual ratios. The z statistic was then calculated as follows:

$$z = \frac{\overline{U}_t - 1}{s}$$

where $\overline{U}_t$ is previously defined and s is the standard deviation of the sample mean price-relative residual ratio.

Isolation of Earnings Announcements. Rejection of the null hypothesis and acceptance of the alternative hypothesis indicates that the residual terms of report periods are significantly greater than the normal or mean nonreport period residual. If these residuals are a function of bond price changes and if bond price changes adjusted for

market effects are a function of factors unique to the firm, it is necessary to ascertain that it was an earnings announcement and not some other news unique to a firm which produced the larger than normal price change in the report period. To determine that no unique news other than the annual earnings announcement was responsible for an observed price change during the earnings announcement period it was necessary to scan the financial press for public news releases regarding firms with bond issues included in this research. If during earnings announcement periods such news items were made public, it would be difficult with the above described methodology to identify what portion of the observed price reaction may be ascribed to the annual earnings announcement and what portion is a result of bond investors impounding the other news item or items in the price of the bond.

The Wall Street Journal Index was the resource used to determine if significant news releases other than annual earnings announcements occur during earnings announcement periods. The Index includes an annual summary of the dates information regarding a firm is published in The Wall Street Journal. By reviewing the Index it was possible to determine what information pertaining to any firm in the sample was released during the same bi-weekly period in which annual earnings were announced. As indicated in Table III, page 54, this factor accounted for the exclusion from the sample of bond issues of six firms. Typical of the type of news announcement reported during the annual earnings announcement period which disqualifies a firm's bond issue from the sample were news releases regarding increases or decreases in dividends, information regarding contracts received, information regarding first quarter earnings, and executive personnel changes.

Adherence to the Assumptions of the Regression Model

The error term, u_{it}, is expected to conform to the following assumptions of the linear model.

1. The expected value of the error term, u_{it}, is zero. The nine bi-weekly report periods are excluded from the regression because the expectation of u_{it} during these periods is not zero.

2. The disturbance term, u_{it}, and the FAI (Factor Analysis Index) are uncorrelated.

3. The u_{it} are not autocorrelated, i.e., the u_{it} are independent of each other.[16]

The regression model is a relatively robust model; therefore, strict adherence to the assumptions of the model is not necessary. However, because there is not a well developed body of literature regarding use of the regression model in bond market research, it was appropriate to consider the possibility of unacceptable levels of autocorrelation in the u_{it} or error term. This consideration of the possibility of autocorrelated disturbances is especially relevant when working with time series data.

> Autocorrelated disturbances arise most frequently in the estimation of relationships from time-series-data. . . . (K)nowledge of the autoregressive structure of the disturbances improves the efficiency of our estimation process as compared with the estimators yielded by simple least-squares.[17]

Applying simple least-squares regression to data containing an autoregressive structure for the purpose of obtaining estimators

---

[16] Hubert M. Blalock, Jr., Social Statistics (St. Louis, 1972), p. 367.

[17] J. Johnston, Econometric Methods (New York, 1963), pp. 195-196. Emphasis supplied by the author.

$\hat{\alpha}$ and $\hat{\beta}$ and making a prediction such as

$$\hat{Y}_t = \hat{\alpha} + \hat{\beta} \quad X_t$$

can result in an inferior prediction. First, the prediction will be biased since it takes no account of recent disturbances. And second, the prediction will be less efficient since the least-squares estimators $\hat{\alpha}$ and $\hat{\beta}$ are not efficient.[18]

To test the data used in this study for autocorrelation of the disturbance terms, the Durbin-Watson statistic, d, was calculated for each bond issue in the sample according to the formula[19]

$$d = \frac{\sum_{i=1}^{131} (\Delta\hat{u}_i)^2}{\sum_{i=1}^{131} \hat{u}_i^2}$$

where:

$\Delta\hat{u}_i = \hat{u}_{it} - \hat{u}_{it-1}$ or the change in the disturbance term of bond issue i from time period t-1 to time period t.

Table VIII is a frequency distribution of the Durbin-Watson statistic, calculated for each bond issue included in the research sample. As indicated in this table, twenty bond issues' residuals contain autocorrelation such that the null hypothesis of autocorrelation in residual terms could not be rejected at the 90% level of confidence. In a population with no autocorrelation it would not be unexpected to find some chance incidence of serial dependency. However the probability of finding twenty of eighty-five firms with d values beyond the critical values of the Durbin - Watson statistic by chance is only

---

[18] Ibid., p. 197.

[19] Ibid.

.0001.[20] Because there appeared to be significant autocorrelation of residual terms, a data transformation technique described by Johnston[21] was used to estimate new α and β parameters by utilizing knowledge of the autoregressive structure.

TABLE VIII

FREQUENCY DISTRIBUTION OF DURBIN-WATSON STATISTIC

Test Statistic Values	Number of Bond Issues
1.37 - 1.62*	6
1.63 - 2.38	65
*2.39 - 2.84	14
Total	85

*Critical values of the Durbin-Watson test statistic at the 90% level of confidence. Taro Yamane, Statistics: An Introductory Analysis (New York, 1973) p. 1096.

Knowledge of the autoregressive structure of the residual terms was obtained by entering the residual terms originally calculated with

[20]The computed z statistic is 3.99518. Given a sample size of 85 bond issues the associated Type I error is .0001. Taro Yamane, Statistics: An Introductory Analysis (New York, 1973), p. 1079.

[21]Johnston, pp. 195-199.

the original data into the following model:[22]

$$r_i = \frac{\sum_{t=2}^{n} (\hat{u}_{it}) (\hat{u}_{it-1})}{\sum_{t=2}^{n} (\hat{u}_{it-1})^2}$$

where:

r_i = the coefficient of a first-order autoregressive scheme in the residuals of bond issue i, and

$\hat{u}_{it}$ and $\hat{u}_{it-1}$ = the residuals of bond issue i in time periods t and t-1, respectively, as computed with the previously defined model $\hat{u}_{it} = PR_{it} - (\alpha_i + \beta_i FAI_t)$.

The purpose of estimating r_i is to use it to transform the original data, bond issue returns and market index returns, to eliminate the autoregressive structure which existed in that data. The transformation was accomplished as follows:

$$PR'_{it} = PR_{it} - r_i PR_{it-1}, \text{ and}$$

$$FAI'_{it} = FAI_t - r_i FAI_{t-1}$$

where:

PR'_{it} and FAI'_{it} = transformation of original bond and market return data, respectively, for bond issue i in time period t,

PR_{it} and FAI_t = the original bond and market return data respectively for bond issue i in time period t, and

r_i = as defined above.

The transformed price relatives and market index returns were substituted for the original data and the test statistic was calculated utilizing the methodology described above.

---

[22] Ibid., p. 198.

Data Sources

Several data sources were mentioned in the previous sections of this chapter. For the sake of organization and clarity, however, a summary of the sources utilized in this research follows. Bond prices and the Dow Jones Index of Ten Industrial Bonds are gathered from various issues of Barron's from the September 18, 1967, through the July 9, 1973, issues.[23] Annual earnings announcement dates and significant news announcements made during the period annual earnings were announced were taken from the Wall Street Journal Index.[24]

Limitations of the Methodology

Bond issues of firms in highly regulated industries were purposely excluded from this research to provide a more homogeneous sample of bond issues and fewer factors external to the firm to control for in the methodology. Therefore, caution should be used in generalizing the results of this study to the bond market as a whole. And, as discussed in Chapter IV, the domination of the sample by December 31 year-end firms imposed limitations.

Another study limitation of undetermined significance is the large number of bond issues in the universe which were excluded from the sample by virtue of an excessive number of periods for which a bond price is not quoted in Barron's. The relative infrequency of market

---

[23] Dow Jones & Company, Inc., Barron's, various issues 1967-1973.

[24] Dow Jones & Company, Inc., The Wall Street Journal Index, various volumes 1968-1972.

transactions involving these bond issues differentiates them from the bond issues included in the sample and prohibits generalizations of the inferences of this study to all corporate bonds.

Still other, but less significant, limitations were the exclusion of bond issues traded on the American Exchange and the restriction of the period of analysis to the years 1968 through 1972. As noted earlier, the proportion of bonds traded each year on the American Exchange is not large relative to total annual bond trades; therefore, this limitation was not considered a serious qualification of the inferences drawn from this research.

This research, as is all empirical research, was limited to a specific time period, in this case 1968 through 1972. Because of unique factors in prior or subsequent time periods, the inferences drawn from this research should not be generalized to all periods without qualification. The inclusion of five years in the analysis was an attempt to mitigate the effect of unusual, temporary factors, but there was a limit to the time period it was feasible to consider in the analysis. To the extent that the five-year period from which data is gathered is representative of other periods the conclusions of the research may be generalized to other periods; however, to the extent the period is not representative of other periods care should be exercised in drawing inferences for such other periods.

Summary

In this chapter the general research hypothesis of this study was presented and made operational through a statistical hypothesis. The universe from which the sample is drawn was described and criteria for

inclusion in the sample were set forth. The methodology for deriving the test statistic was presented and a description of a transformation process to meet the assumptions of the regression model included. Finally, a summary of the sources of the data used in this research was presented, and the limitations of the research were cited.

CHAPTER IV

RESULTS OF THE STATISTICAL TEST

Introduction

This chapter reports the results of the statistical test of the hypothesis presented in the previous chapter. In addition to testing this hypothesis the bond issues in the sample were classified into two groups on the basis of their being convertible or nonconvertible, and the afore described analysis was performed on the two groups of bond issues. The results of the statistical tests applied to these two gourps are presented in this chapter, and conclusions and implications drawn from all of the reported results are included.

Results of the Statistical Test of the Principal Hypothesis of This Study

The Complete Sample as a Whole

The research hypothesis of this study is concerned with the information content of annual earnings announcements as perceived by corporate bond investors. The hypothesis states:

Null Hypothesis, H_o: The annual earnings announcements of corporate bond issuers do not have information value to corporate bond investors.

Alternative Hypothesis, H_a: The annual earnings announcements of corporate bond issuers do have information value to corporate bond investors.

A least-squares regression model was used to remove from the price relative of a specific bond during a particular time period that portion of the return hypothesized to be the result of market or economy-wide factors. The remaining portion of the price relative was hypothesized to be the result of information unique to a particular firm. The unique portion of the price relative computed during an earnings announcement period was then compared to the mean unique portion of the price relative as computed over several nonreport periods by dividing the former by the latter. The rationale behind this procedure was that if earnings announcements of corporate bond issuers contain information or "news" which is impounded by bond investors in the price of bonds as they make buy, sell or hold decisions, the unique portion of the price relative during periods of annual earnings announcements will exceed the unique portion of the price relative during nonreport periods -- periods during which earnings announcements are not made. Or stated in terms of the test statistic $\bar{U}_{it}$, which is the result of dividing report period price relative residuals by average nonreport period residuals:

H_o: The mean ratio of residuals in periods during which annual earnings are announced to residuals in nonreport periods is equal to unity, i.e., $H_o: \bar{U}_t = 1.0$.[1]

H_a: The mean ratio of residuals in earnings announcement periods to residuals in nonreport periods is greater than unity, i.e., $H_a: \bar{U}_t > 1.0$.

The values of the test statistic $\bar{U}_t$ for each of the nine time periods t = -4 to t = +4 are presented in Table IX. The value of $\bar{U}_t$ is

---

[1] $\bar{U}_t$: the mean, across firms and years, of the ratio of report period residual for bi-weekly earnings report period t, where t = -4 to +4, to the average nonreport period residual.

TABLE IX

SAMPLE RESULTS OF AVERAGE PRICE-RELATIVE RESIDUAL RATIO BETWEEN EARNINGS ANNOUNCEMENT AND NONANNOUNCEMENT PERIODS--COMPLETE SAMPLE

Two-Week Period Relative to Two-Week Period During Which Annual Earnings are Announced (o)	Sample Mean Price-Relative Residual Ratio [A]	Sample Variance [B]	Sample z $\left[\frac{A-1}{B}\right]$	Probability of z Statistic Occurring by Chance
-4	1.3336	0.0646	5.16	.0001
-3	1.1683	0.0540	3.12	.0009
-2	1.1888	0.0526	3.59	.0002
-1	1.2322	0.0509	4.56	.0001
0	1.0849	0.0455	1.87	.0307
+1	1.1079	0.0510	2.12	.0170
+2	1.0802	0.0485	1.65	.0495
+3	1.1228	0.0559	2.20	.0139
+4	1.1233	0.0500	2.47	.0068

greater than unity for all nine two-week intervals designated as part of the report period. It can be noted by reference to the sample mean price-relative residual ratios in Table IX that in any one of the four two-week periods preceding the period of earnings announcement the ratio of any subsequent two-week period in the report period -- including the two-week period during which firms announced earnings. (See Figure 3.)

Given (1) an efficient market, (2) no information leaks regarding annual earnings prior to the announcement in The Wall Street Journal, and (3) an assumption of information in earnings announcements which investors impound in security prices, it would be expected that the mean price-relative residual ratio will not be significantly greater than unity in the periods preceding and following the period in which annual earnings are announced and will be significantly greater than unity in the period of earnings announcement. Stated in terms of the test statistic and the statistical test of significance, it is hypothesized that if annual earnings announcements are efficiently impounded by investors in bond prices, the test statistic, $\overline{U}_t$, will not be significantly greater than unity in all bi-weekly report periods except that two-week period during which firms announce annual earnings. And in that period the $\overline{U}_t$ is expected to be significantly greater than one. If this hypothesis holds, the null hypothesis that $\overline{U}_t$ is equal to unity should not be rejected for any of the nine bi-weekly report periods except period zero, the period of the earnings announcement. In period zero the expected value of $\overline{U}_t$ is greater than unity and, therefore, the null hypothesis should be rejected in period zero.

On the basis of the complete sample of bonds included in this study, however, it is possible to reject at the ninety-five percent confidence level the null hypothesis of the mean residual not being significantly greater than unity for all the nine two-week periods in the period of analysis. The second two-week period following the announcement of annual earnings (period "+2") comes closest to providing a z statistic which may not be rejected.

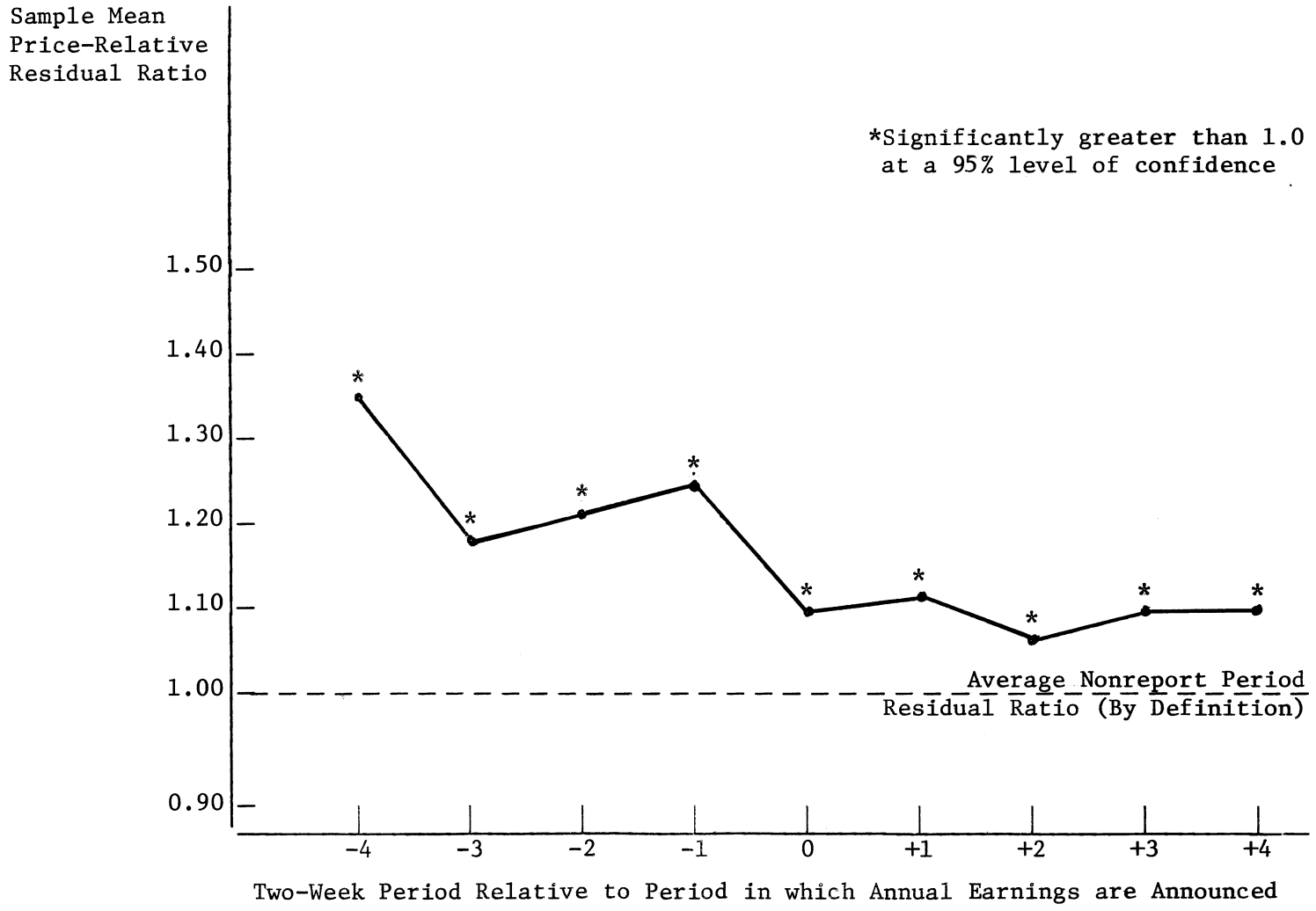


Figure 3. Price Residual Ratio Analysis; Complete Sample

The Sample as Divided into Convertible and Nonconvertible Bonds

Because these results do not conform to the expectations formulated under the efficient capital markets hypothesis and described in Chapter II, further analysis is warranted. In Chapter III it was reported that a principal component analysis of bond price changes identified two principal components accounting, respectively, for approximately twenty-four percent and six percent of the variance in the prices of the bonds included in the sample. The first of these principal components was interpreted as being the effect of general market information on bond prices. The second principal component was interpreted as being a surrogate for the convertible or nonconvertible feature of each bond. It was reported that through an analysis of factor loading scores it was possible to correctly classify as convertible or nonconvertible eighty-eight percent of the bonds included in the sample. Because this analysis of principal components indicates that there is some rather distinct difference, relative to an index of price changes, in the price changes of convertible versus nonconvertible corporate bonds, an appropriate action appears to be to conduct an analysis of each type of bond separately as if two distinct samples were drawn from two distinct populations, i.e., the population of convertible bonds and the population of nonconvertible bonds. The results of these analyses by classification as convertible or nonconvertible bonds are presented in Table X, page 85, and Table XII, page 92.

TABLE X

SAMPLE RESULTS OF AVERAGE PRICE-RELATIVE RESIDUAL RATIO BETWEEN EARNINGS ANNOUNCEMENT AND NONANNOUNCEMENT PERIODS--CONVERTIBLE BONDS

Two-Week Period Relative to the Two-Week Period During Which Annual Earnings are Announced (o)	Sample Mean Price-Relative Residual Ratio [A]	Sample Variance [B]	Sample z $\left[\frac{A - 1}{B}\right]$	Probability of z Statistic Occurring by Chance
-4	1.2280	0.0715	3.19	.0007
-3	1.1359	0.0654	2.08	.0188
-2	1.1028	0.0628	1.64	.0505
-1	1.2714	0.0667	4.07	.0001
0	1.0334	0.0513	0.65	.2578
+1	1.0521	0.0619	0.84	.2004
+2	1.0733	0.0604	1.21	.1131
+3	1.0409	0.0589	0.69	.2451
+4	1.0740	0.0572	1.29	.0985

Convertible Bonds. In the case of convertible corporate bonds it can be noted by reference to Table X and Figure 4 that the mean price-relative residual ratio in periods plus one through plus four are not significantly greater than unity at a ninety-five percent level of confidence. This is as expected under the assumptions of the efficient capital markets hypothesis. In effect, taken by itself, this

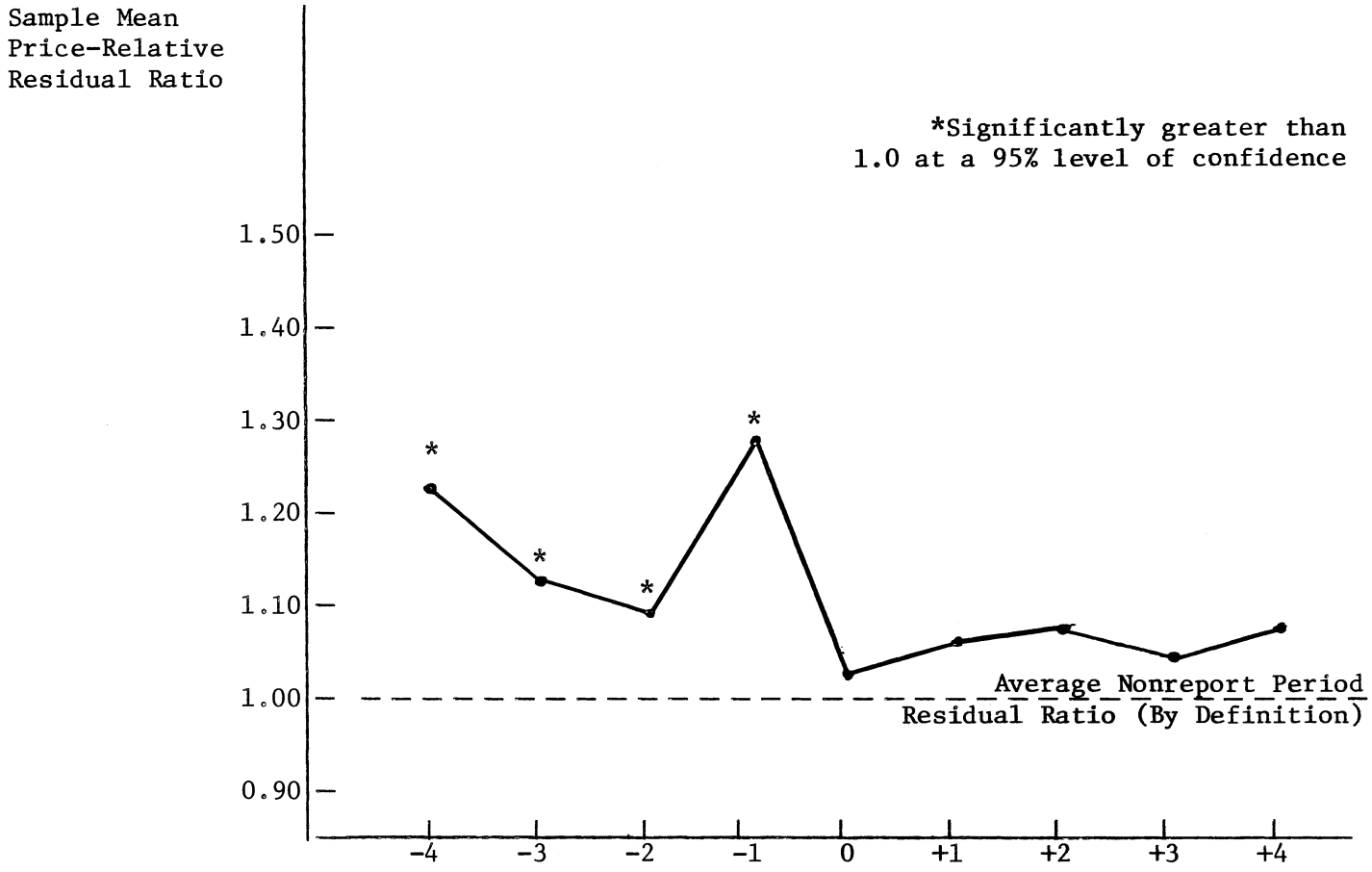


Figure 4. Price Residual Ratio Analysis: Convertible Bonds

implies that evidence exists which is consistent with the conclusion that the convertible bond market is efficient as evidenced by the fact that significantly greater than average returns on investment cannot be earned solely on the basis of information from the publicly available annual reports of earnings.

A result of the analysis which is not consistent with previously reported stock market research is the lack of a significantly greater than unity ratio in period zero, the two-week period during which the earnings announcement is formally announced in The Wall Street Journal. This result, however, does not by itself indicate that corporate convertible bond investors do not impound annual earnings announcements in the convertible bond prices established in the market.

At least one possible explanation may account for some of the difference between this study and Beaver's research in the stock markets regarding the timing of the noted price reaction to annual earnings announcements. Beaver noted the greatest price reaction of common stock to earnings announcements in the week during which earnings were announced, "zero week."[2] This research, however, indicates that the largest noted reaction occurs in the period preceding the annual earnings announcement period, period zero. (See Figure 4.)

Although it is not possible with the data at hand to empirically support this hypothesis, the nature of the bond market as opposed to the stock markets may at least conceptually account for some of the observed variations from expected or hypothesized results, i.e., the

---

[2]Beaver, "The Information Content of Annual Earnings Announcements," p. 91.

extent of leakage observed in period minus one. The bond markets are undoubtedly dominated by institutional investors to a considerable degree more than such investors dominate the stock markets.[3] This domination of the bond markets by institutional investors may account for the considerable leakage of earnings information noted in the bi-weekly period preceding the earnings announcement period. To the extent that institutional investors are more sophisticated investors and can make more effective demands for "inside information," and to the extent corporate executives are responsive to these high-powered demands for more timely information, it appears reasonable to conclude that more earnings announcement leakages may occur in the bond markets than the stock markets. Even if actual earnings announcements are not leaked prior to public announcement, institutional investors may have access to other data from corporate bond issuers which allow these investors to develop rather accurate and reliable estimates of earnings yet to be publicly disseminated.

Of course, any earnings related data "leaked" to institutional investors could also be of use in the stock markets and thus account for the considerable anticipation of earnings announcements observed by Beaver.

> Although the price activity is highest in week 0, the next largest values occur in the weeks immediately contingent to week 0. Price changes are above average in the week immediately prior to the announcement, which may reflect information leakage

---

[3] Graham, Dodd, and Cottle estimate that approximately twenty-five percent or more of common stocks outstanding and about ninety percent of corporate bonds are held by financial intermediaries. Graham, Dodd, and Cottle, p. 59.

> or the fact that The Wall Street Journal was not the first source to report the earnings in some cases.[4]

It should be noted, however, that the extent of the leakage noted by Beaver in the stock market is not as extensive as the leakage noted in this research. This difference may be partially explained by the relative domination of the bond and stock markets by institutional investors, ninety and twenty-five percent, respectively.

Of course, there are possibly other explanations for the observed differences between the convertible bond analysis and the expected results. Perhaps the convertible sample of fifty-six bonds was rather small and not adequate to mitigate noise in the data. Or perhaps the domination of the sample by bond issues of firms with December 31 financial year-ends contributed to the disparity in the results observed. (See Table XI.) It seems possible that the market model was inadequate to control for the market effect of the clustering of annual earnings announcements and other sources of financial information regarding results of operations around the end of the calendar year and during the interim eight to ten week period before which a majority of firms announce annual earnings.

On balance, however, the result of the convertible bonds analysis is in conformity with the expectation that convertible bond investors perceive annual earnings announcements as data relevant to the investment decision-making process and, therefore, as information to be impounded in convertible bond prices. And although the research methodology of this study was based on an assumption of bond market

---

[4] Beaver, "The Information Content of Annual Earnings Announcements," p. 81.

efficiency, there is some indication--at least from the analysis of convertible bond data--that this assumption is realistic or reasonable.

TABLE XI

FREQUENCY DISTRIBUTION OF FINANCIAL YEAR-END DATES OF THE FIRMS WITH BONDS INCLUDED IN THE SAMPLE

Financial Year End Date	Total	Convertible	Nonconvertible
January 31	2	0	2
February 28	1	1	0
March 31	1	1	0
May 31	1	1	0
June 30	6	5	1
July 31	7	5	2
September 30	4	4	0
October 31	3	2	1
November 30	1	1	0
December 31	59	36	23
Total Firms	85	56	29

The noted price reaction to annual earnings announcements dissipates rapidly as would be expected in an efficient market, i.e., a market which rapidly and in an unbiased manner impounds all publicly available information (semi-strong form).

Nonconvertible Bonds. The analysis of the nonconvertible bonds results in at least one positive conclusion regarding the research

hypothesis which states that annual earnings announcements contain information useful to corporate bond investors as they make their investment decisions. That conclusion is that it is quite likely that the overall results described above (See Table X and Figure 3.) may in fact be inconclusive or not in conformity with expectations due to the nonconvertible bonds included in the overall sample. In other words, the complete sample results described above appear to be influenced by the nonconvertible bonds in the sample.

As illustrated in Table XII and Figure 5, it is not possible to interpret the nonconvertible bond analysis results in any manner which is consistent with the information content of annual earnings announcements hypothesis, given an efficient capital market assumption. It is possible to reject the null hypothesis in all report periods except period plus two (+2). To be consistent with expectations it should not be possible to reject the null hypothesis in all periods except period zero, the earnings announcement period. To be consistent with the results of the convertible bond analysis, period minus one (-1) should be the only period from period minus two (-2) through plus four (+4) for which the null hypothesis could be rejected.

It should be noted, however, that this does not automatically imply that investors in nonconvertible bonds do not impound earnings announcement information in the prices of bonds. The results may instead provide evidence that the nonconvertible investor not only does include earnings announcements in the information set utilized in making investment decisions but also that the time lag between the time the earnings information is made public and the time by which nonconvertible bond prices reflect all of the information therein is greater than

expected in a truly efficient capital market. This latter possibility is supported at least conceptually by some recently reported research.[5]

TABLE XII

SAMPLE RESULTS OF AVERAGE PRICE-RELATIVE RESIDUAL RATIO BETWEEN EARNINGS ANNOUNCEMENT AND NONANNOUNCEMENT PERIODS -- NONCONVERTIBLE BONDS

Two-Week Period Relative to the Two-Week Period During Which Annual Earnings Are Announced (o)	Sample Mean Price-Relative Residual Ratio [A]	Sample Variance [B]	Sample z $\left[\frac{A - 1}{B}\right]$	Probability of z Statistic Occurring by Chance
-4	1.5377	0.1280	4.20	.0001
-3	1.2309	0.0953	2.42	.0078
-2	1.3549	0.0938	3.78	.0001
-1	1.1565	0.0754	2.08	.0188
0	1.1846	0.0890	2.07	.0192
+1	1.2157	0.0896	2.41	.0080
+2	1.0935	0.0814	1.15	.1251
+3	1.2811	0.1172	2.40	.0082
+4	1.2187	0.0960	2.28	.0113

[5]Steven Katz, "The Price Adjustment Process of Bonds to Rating Reclassifications: A Test of Bond Market Efficiency," The Journal of Finance, XXIX (May, 1974), pp. 551-559. Katz, with a sample of utility bonds--all nonconvertibles--found that a six to ten week lag existed between a change in the rating of a bond and 100% adjustment of yield to maturity.

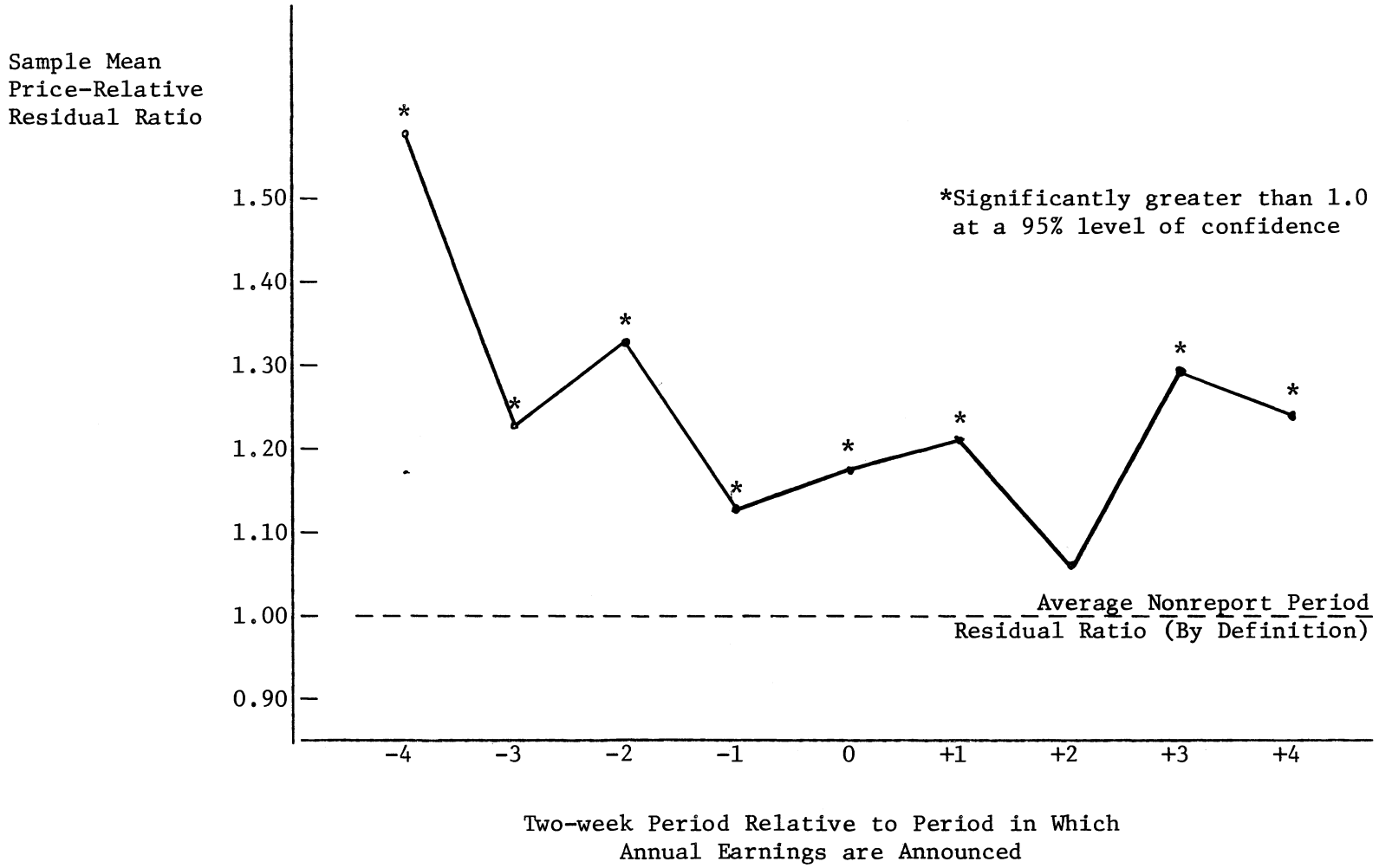


Figure 5. Price Residual Ratio Analysis: Nonconvertible Bonds

And of course, the nonconformity of the nonconvertibles to the result of the convertible bond analysis was not entirely unexpected after the results of the factor analysis procedure described in Chapter III were reviewed. Those results indicated that the two types of securities possessed unique characteristics and, therefore, might react differently to earnings announcements.

Other factors are possible explanations for the discrepancy between expected and actual results regarding the nonconvertible bond analysis. Among them are possible model misspecification and a sample of nonconvertibles (twenty-nine) too small to be representative and unbiased by extraneous factors. The important point to make at this point is that there is tenuous evidence provided by this study which can be interpreted as indicating that nonconvertible bond investors perceive accounting earnings announcements as information and, therefore, include earnings announcements in the data set which establishes nonconvertible bond prices. Although the hypothesized rapid adjustment to earnings announcements did not occur in the nonconvertible market, the ratio of report period residuals to nonreport period residuals remained greater than unity during periods following earnings announcements. This may be interpreted as implying information value in earnings announcements. The noted lag in the impounding of the earnings announcement may possibly be attributed to model misspecification. The model of the relation between the return on a particular issue and the market may not reflect changes in systematic risk induced by changes in accounting earnings as rapidly as these risk changes occur. The smoothing effect of this failure to reflect quickly any changes in systematic risk may explain the persistence of the abnormal price movements of

nonconvertibles. Nevertheless, the conclusion that accounting earnings data are important to bond investors appears probable.

Implications of the Results

The implications of this research must be described from the vantage point of the objectives of the study. As stated in Chapter I, this study represented an attempt to extend the efficient capital market research beyond the stock markets and into the bond markets. And at the same time the purpose of this research was described as to confirm or refute the acceptability of the tendency of others to generalize regarding accounting-based information from stock market research to securities markets. It was pointed out that several attempts have been made to generalize stock market research to the more inclusive securities markets and, on the basis of such generalizations, to make accounting policy recommendations to accounting rule-making bodies. The possible consequences of such generalizations were assessed in regard to the significance of the bond markets as a source of additional investment capital.

Although this study was subject to some limitations of methodology and sample selection, it appears possible to draw several qualified conclusions. First, there appears to be, as a result of the completion of this research, one piece of evidence which suggests that it is possible to assume that the stock markets and the convertible bond markets react similarly with respect to accounting information. In other words, this research provides evidence that corporate convertible bond market investors impound annual earnings announcements in bond prices in a manner comparable to common stock investors. If this is the case,

some research with respect to the efficiency with which such earnings announcements are impounded in common stock prices may be generalized to the convertible bond markets. However, before accounting policy recommendations based on this research are appropriate, additional research regarding the bond market investor is warranted. For example, it will be necessary to provide evidence that bond investors see through accounting method changes to the underlying real economic events in making investment decisions before it can be recommended that accounting rule-making bodies may eliminate particular currently acceptable accounting alternatives without adverse effects on bond and stock prices.

Summary

Although the result of the original all-inclusive sample of bonds analysis was difficult to interpret, separation of the sample into its convertible and nonconvertible segments yielded results which imply that bond investors include annual earnings announcements in the information set employed in the investment decision. Investors in convertible securities appear to impound earnings announcements quickly as judged from this analysis; however, this study does not provide evidence that nonconvertible investors are as timely in impounding earnings announcement information. Although methodological limitations may more likely account for the detected lag in the adjustment to earnings announcements, it is possible, and consistent with research cited above, that the nonconvertible investor is not as rapid in adjusting prices for new information as is the investor in common stock or convertible bonds. The implication of the conclusion drawn from this study is that it is

no longer necessary to subjectively equate the bond and stock markets. This study reduces the subjective aspects of generalizing stock market research results to the bond market as a basis for making policy recommendations to accounting rule-making bodies.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary of the Research

A considerable quantity of empirical research regarding the association between accounting information and the market-established prices of common stocks has been reported in the literature. The result of this research has been rather widespread (though admittedly incomplete) revision of heretofore popular beliefs about investor behavior with respect to accounting information. An example of the implications this research has had is the recent reluctance of the Financial Accounting Standards Board to accept at face value arguments that lease capitalization would adversely affect firms heavily levered with off-balance sheet financing. All of the published research which has led to this revision of models of investor behavior however, has been conducted in the common stock markets and the accounting policy implications have been drawn from the limited (in scope) research. The stock market research has been generalized from the common stock markets to the "securities" markets and policy recommendations presented to accounting rule-making bodies on the basis of such generalizations. However. to the extent the bond markets are significant sources of capital and have unique characteristics such generalization of stock market research to bond markets is premature.

This study was conducted to determine if the reported relations between accounting information and stock prices persists in the corporate bond markets. Although there was no a priori reason to believe that observed relations between accounting-based information and share prices in the stock markets are significantly different than in the bond markets, empirical testing of the question was considered appropriate in light of the differences which exist between the nature and composition of the two markets and the significance of the bond markets as a source of corporate capital. The possible consequences of erroneously generalizing to the securities markets from stock market research when proposing accounting policy is especially potentially damaging when considered in regard to the dominating proportion of total additional capital acquired by existing firms which comes from the corporate bond markets. At least two possible purposes were considered at the outset of this research: (1) an addition to the existing research regarding capital markets and the impounding of accounting information in "security" prices, and (2) a possible reduction in the subjectivity of a decision to generalize stock-market-research-based conclusions and implications to the more general securities markets.

The research hypothesis that the annual earnings announcements of corporate bond issuers have information content to corporate bond investors was subjected to empirical testing as a proposed first step toward generalizing the important implications of past stock market research to a broader classification of capital markets. As a by-product of the research several other commonalities between bond and stock price were investigated.

A research methodology frequently utilized in stock market research was adapted to this study and used to isolate from the total reaction of a bond to "events" of a particular bi-weekly earnings announcement period that reaction which could theoretically be ascribed to the annual earnings announcement released to the public during that period. In the process of isolating that portion of corporate bond price reaction which could be interpreted as investor impounding of annual earnings announcements in bond prices, an index of corporate bond prices was developed, and tests for serial correlations of returns and an industry effect on bond returns were conducted.

Conclusions

The results of the tests of the original research hypothesis and, more significantly, two related hypotheses applied to a partitioning of the corporate bond market into its convertible and nonconvertible segments provide evidence that corporate bond investors do impound annual earnings announcements in the information set used to make buy-sell-or-hold decisions in the corporate bond markets. Although the results of the original hypothesis were difficult to analyze due to the coexistance of convertible and nonconvertible bond data in the results, further analysis by classification as convertible or nonconvertible resulted in more meaningful conclusions. Both convertible and non-convertible bonds exhibited a greater than normal level of price activity during periods surrounding earnings announcement periods.

Significant differences existed, however, between convertibles and nonconvertibles with respect to the timing of the increased price change activity. Convertible bond issues demonstrated an abnormally

large level of price activity in the period immediately preceding an annual earnings announcement and insignificantly abnormal activity thereafter, including the period of the announcement. This abnormally large price activity in the period before earnings announcement is consistent with the results of related stock market research but exceeds the degree of anticipation of earnings announcements noted in the related research. However, data constraints along with different investor characteristics (domination by institutional investors) may account for the differences in results of this study and the stock market related studies.

The nonconvertible bond analysis provided results which may also be interpreted as consistent with the hypothesis that corporate bond investors do impound annual earnings announcements in the price of bonds. However, this research study raised some questions regarding the efficiency with which the nonconvertible segment of corporate bond markets impounds new information into bond prices. The results of this study indicate that the above normal price activity during earnings announcement periods persists for at least six to eight weeks following the period during which annual earnings were announced. Although this interpretation is consistent with the findings of another research effort recently reported, care must be exercised in attributing too much significance to the finding. The nonconvertible portion of the sample employed in this study consisted of only twenty-nine bonds -- perhaps too few to comprise a representative sample -- and it is also possible that model misspecification may have accounted for the variance of the nonconvertible bond results from those predicted, i.e., the unexpected detected time lag between earnings announcements and

the return of price change activity to normal levels. The important point to note is that the convertible bond analysis provides rather clear evidence and the nonconvertible bond analysis somewhat tenuous evidence that the bond market investor, like the stock market investor, does include accounting annual earnings announcements in the information set used to establish bond prices.

The implications are that there now is some basis for generalizing efficient markets research from the common stock markets to a broader group of "securities." No longer will it be necessary to subjectively assume a bond market reaction similar to a detected reaction in the stock markets; at least the degree of that subjective assumption may be reduced as a result of the completion of this study.

Recommendations

Research of the type conducted in this study depend on replication and confirmation of results to provide an authoritative basis for reliance thereon. It would be particularly desirable to replicate the study using different time periods and an expanded sample size, especially with respect to nonconvertible bonds. After the completion of this study it seems possible that the data collection constraints could be relaxed somewhat to achieve a larger and, therefore, a more representative sample size without a significant effect on the integrity of the results. In fact, a very productive replication might involve the selection of two independent samples from two separate populations (the population of convertible bonds and the population of nonconvertible bonds) instead of the selection of one sample from the more

inclusive population of corporate bonds and the partitioning of that sample into its two component parts as was the procedure in this study.

Also related to the two independent samples suggestion is a recommendation that it may be appropriate to utilize different models to estimate the regression parameters for convertibles and nonconvertibles. It may, for example, be appropriate to include a variable for the bond rating assigned to a particular bond by one of the major rating organizations, particularly with regard to nonconvertible bonds. An interesting question as to the relative significance of annual earnings announcements to bondholders who invest in bonds with substantially different degrees of risk associated with them gives rise to this suggestion.

Several other research possibilities are suggested by reviewing the accounting related efficient capital markets research reported in recent years. The larger the volume of bond market research which evidences consistency between the bond and the stock markets, the smaller will be that "leap of faith" necessary when making accounting policy recommendations on the basis of stock market research. Of course, the most desirable position to achieve is that of such a volume of accounting-related bond market research reported in the literature that it is no longer necessary to speculate as to the similarity or disparity between the two markets' reaction to various accounting policy proposals. Additional bond market-based research should be conducted until those who make accounting policy recommendations can review the literature to obtain a reasonably accurate appraisal of the potential "securities" market repercussions of any suggestion they may consider for proposal.

A SELECTED BIBLIOGRAPHY

Accounting Principles Board. APB Opinion No. 20: Accounting Changes. New York: American Institute of Certified Public Accountants, July, 1971.

Ang, James S. and Dembel Balcha. "On Bond Swap Profitability." (Unpublished paper, Oklahoma State University, Stillwater, Oklahoma, 1974. (Forthcoming in The Journal of Finance.)

Archibald, T. Ross. "Stock Market Reaction to the Depreciation Switch-Back." The Accounting Review, XLVII (January, 1972), pp. 22-30.

Ball, Ray. "Changes in Accounting Techniques and Stock Prices." Empirical Research in Accounting: Selected Studies, 1972. Supplement to Vol. X, Journal of Accounting Research, pp. 1-38.

_____ and Philip Brown. "An Empirical Evaluation of Accounting Income Numbers." Journal of Accounting Research, VI (Autumn, 1968), pp. 159-178.

_____ and Philip Brown. "Portfolio Theory and Accounting." Journal of Accounting Research, VII (Autumn, 1969), pp. 300-321.

Barrett, M. Edgar. "Accounting for Intercorporate Investments: A Behavior Field Experiment." Empirical Research in Accounting: Selected Studies, 1971. Supplement to Vol. IX, Journal of Accounting Research, pp. 50-65.

Baskin, Elba F. and Gary M. Crooch. "Historical Rates of Return on Investments in Flat Bonds." Financial Analysts Journal, XXIV (November-December, 1968), pp. 95-97.

Baumol, William J., Burton G. Malkiel and Richard E. Quandt. "The Valuation of Convertible Securities." Quarterly Journal of Economics, LXXX (February, 1966), pp. 48-59.

Beaver, William H. "The Behavior of Security Prices and Its Implications for Accounting Research (Methods)." Report of the Committee on Research Methodology in Accounting. The Accounting Review. Supplement to Vol. XLVII (1972), pp. 407-437.

_____. "The Information Content of Annual Earnings Announcements." Empirical Research in Accounting: Selected Studies, 1968. Supplement to Vol. VI, Journal of Accounting Research, pp. 67-92.

_____ and Roland E. Dukes. "Interperiod Tax Allocation, Earnings Expectations, and the Behavior of Security Prices." The Accounting Review, XLVII (April, 1972), pp. 320-332.

Blalock, Hubert M., Jr. Social Statistics. St. Louis: McGraw-Hill Book Company, 1972.

Bond Guide. Vol. XXXVI. New York: Standard and Poor's Corporation, December, 1972.

Brigham, Eugene F. "An Analysis of Convertible Debentures: Theory and some Empirical Evidence." The Journal of Finance. XXI (March, 1966), pp. 35-54.

Brown, Philip and John W. Kennelly. "The Information Content of Quarterly Earnings: An Extension and Some Further Evidence. Journal of Business, XLV (July, 1972), pp. 403-415.

Bruns, William J. "Inventory Valuation and Management Decisions." The Accounting Review, XL (April, 1965), pp. 345-357.

Cooley, William W. and Paul R. Lohnes. Multivariate Data Analysis. New York: John Wiley & Sons, Inc., 1971.

Dixon, W. J. (ed.). BMD: Biomedical Computer Programs. Los Angeles: University of California Press, 1971.

Dow Jones & Company, Inc. Barron's various issues during the years 1967-1973.

Dow Jones & Company, Inc. The Wall Street Journal, LIV (October 1, 1974), p. 14.

Dow Jones & Company, Inc. The Wall Street Journal Index, various volumes for the years 1968-1972.

Dyckman, T. R. "The Effects of Alternative Accounting Techniques on Certain Management Decisions." Journal of Accounting Research, II (Spring, 1964), pp. 91-107.

_____. "On the Effects of Earnings-Trend, Size and Inventory Valuation Procedures in Evaluating a Business Firm." Research in Accounting Measurement, R. K. Jaedicke, Y. Ijiri, and O. Nielsen, editors. Iowa City, Iowa: American Accounting Association, 1966, pp. 175-185.

_____. "On the Investment Decision." The Accounting Review, XXIX (April, 1964), pp. 285-295.

Fama, Eugene F. "The Behavior of Stock Market Prices." Journal of Business, XXXVIII (January, 1965), pp. 34-105.

_____. "Efficient Capital Markets: A Review of Theory and Empirical Work." The Journal of Finance, XXV (May, 1970), pp. 383-417.

_____, Lawrence Fisher, Michael Jensen, and Richard Roll. "The Adjustment of Stock Prices to New Information." International Economic Review, X (February, 1969), pp. 1-21.

Fisher, Lawrence. "Determinants of Risk Premium on Corporate Bonds." The Journal of Political Economy, LXVII (June, 1959), pp. 217-237.

Francis, Jack Clark and Stephen H. Archer. Portfolio Analysis. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971.

Garcia, F. L. Glenn G. Munn's Encyclopedia of Banking and Finance. Seventh Edition. Boston: Bankers Publishing Company, 1973.

Graham, Benjamin, David L. Dodd and Sidney Cottle. Security Analysis: Principles and Technique. New York: McGraw-Hill Book Company, Inc., 1962.

Grunewald, Adolph E. and Erwin E. Nemmers. Basic Managerial Finance. Dallas: Holt, Rinehart and Winston, Inc., 1970.

Haley, Charles W. and Lawrence D. Schall. The Theory of Financial Decisions. St. Louis: McGraw-Hill Book Company, 1973.

Hays, William L. Statistics. Chicago: Holt, Rinehart and Winston, Inc., 1963.

Horrigan, James O. "The Determination of Long-Term Credit Standing with Financial Ratios." Empirical Research in Accounting: Selected Studies, 1966. Supplement to Vol. IV, Journal of Accounting Research, pp. 44-62.

Jensen, Robert E. "An Experimental Design for Study of Effects of Accounting Variations on Decision Making." Journal of Accounting Research, IV (Autumn, 1966), pp. 224-238.

Johnston, J. Econometric Methods. New York: McGraw-Hill Book Company, Inc., 1963.

Kaplan, Robert and Richard Roll. "Investor Evaluation of Accounting Information: Some Empirical Evidence." The Journal of Business, XLV (April, 1972), pp. 225-257.

Katz, Steven. "The Price Adjustment Process of Bonds to Rating Reclassifications: A Test of Bond Market Efficiency." The Journal of Finance, XXIX (May, 1974), pp. 551-559.

Kiger, Jack E. "An Empirical Investigation of NYSE Volume and Price Reactions to the Announcement of Quarterly Earnings." Journal of Accounting Research, X (Spring, 1972), pp. 113-128.

King, Benjamin F. "Market and Industry Factors in Stock Price Behavior." Journal of Business, XXXIX (Special Supplement, January, 1966), pp. 139-190.

Lev, Baruch. Financial Statement Analysis: A New Approach. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1974.

Litner, John. "Security Prices, Risk, and Maximal Gains from Diversification." The Journal of Finance, XX (December, 1965), pp. 587-612.

Lorie, James H. and Mary T. Hamilton. The Stock Market: Theories and Evidence. Homewood, Illinois: Richard D. Irwin, Inc., 1973.

"Market, Smart or Dumb (The)?" The Wall Street Journal (Editorial), Vol. CLXXXIV, No. 65, (October 1, 1974), p. 14.

Markowitz, Harry M. "Portfolio Selection," The Journal of Finance, XII (March, 1952), pp. 77-91

May, Robert G. "The Influence of Quarterly Earnings Announcements on Investor Decisions as Reflected in Common Stock Price Changes." Empirical Research in Accounting: Selected Studies, 1971, Supplement to Vol. IX, Journal of Accounting Research, pp. 119-163.

Meyers, Stephen L. "A Re-examination of Market and Industry Factors in Stock Price Behavior." The Journal of Finance, XXVIII (June, 1973), pp. 695-705.

Mlnarczyk, F. A., Jr. "An Empirical Study of Accounting Methods and Stock Prices." Empirical Research in Accounting: Selected Studies, 1969. Supplement to Vol. VII, Journal of Accounting Research, pp. 63-89.

O'Donnel, J. L. "Relationship Between Reported Earnings and Stock Prices in the Electric Utility Industry," The Accounting Review, XL (January, 1965), pp. 135-143.

Patz, Dennis H. and James R. Boatsman. "Accounting Principles Formulation in an Efficient Markets Environment," Journal of Accounting Research, X (Autumn, 1972), pp. 392-403.

Philippatos, George C. Financial Management: Theory and Techniques. San Francisco: Holden-Day, Inc., 1973.

Pinches, G. E. and Kent A. Mingo. "A Multivariate Analysis of Industrial Bond Ratings." Journal of Finance, XXVIII (March, 1973), pp. 1-18.

Pogue, Thomas F. and Robert M. Soldofsky. "What's in a Bond Rating?" Journal of Financial and Quantitative Analysis, IV (June, 1969), pp. 201-228.

Securities and Exchange Commission. Annual Report of the Securities and Exchange Commission, XXIX-XXXVIII. Washington, D.C.: U. S. Government Printing Office, 1964-1973.

Shannon, C. E. and W. Weaver. The Mathematical Theory of Communication. Urbana, Illinois: The University of Illinois Press, 1964.

Sharpe, William F. "Bonds Versus Stocks: Some Lessons from Capital Market Theory." Financial Analysts Journal, XXIX (November-December, 1973), pp. 74-80.

_____. "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk." The Journal of Finance, XIX (September, 1964), pp. 425-442.

Soldofsky, Robert M. and Garnet D. Olive. Financial Management. Dallas: South-Western Publishing Co., 1974.

Summers, Edward L. "Observation of Effects of Using Alternative Reporting Practices." The Accounting Review, XLIII (April, 1968), pp. 257-265.

VanHorne, James C. Financial Management and Policy. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1974.

Wall Street Journal (The), Vol. CLXXI, No. 1 (January 2, 1973), pp. 22 and 32.

Walter, James E. and Agustin V. Que. "The Valuation of Convertible Bonds." The Journal of Finance, XXVIII (June, 1973), pp. 713-732.

Yamane, Taro. Statistics: An Introductory Analysis. New York: Harper and Row, Publishers, 1973.

APPENDIX A

BOND ISSUES INCLUDED IN THE STUDY

APPENDIX A

BOND ISSUES INCLUDED IN THE SAMPLE

Issuing Firm	Contract Rate of Interest	Maturity	Convertible
Air Reduction Company, Inc. (Airco, Incorporated)	3 7/8	1987	Yes
Allied Chemical & Dye Corp. (Allied Chemical Corp.)	3 1/2	1978	No
Allied Supermarkets, Inc.	5 3/4	1987	Yes
Aluminum Company of America	5 1/4	1991	Yes
Amerace Esna Corporation (Amerace Corporation)	5	1992	Yes
American Airlines, Inc.	4 1/4	1992	Yes
American Hoist & Derrick Co.	4 3/4	1992	Yes
American Smelting & Refining Co.	4 5/8	1988	No
American Sugar Company (Amstar Corporation)	5.30	1993	No
Automatic Canteen Company of America (Canteen Corporation)	4 3/4	1981	Yes
Berkey Photo, Inc.	5 3/4	1986	Yes
Bethlehem Steel Corp.	4 1/2	1990	No
Braniff Airways, Inc.	5 3/4	1986	No
Brunswick Corporation	4 1/2	1981	Yes
Burlington Industries, Inc.	5	1991	Yes
Celanese Corporation of America (Celanese Corporation)	4	1990	Yes
Cessna Aircraft Company	3 7/8	1992	Yes
Cities Service Company	3	1977	No

APPENDIX A

BOND ISSUES INCLUDED IN THE SAMPLE (Continued)

Issuing Firm	Contract Rate of Interest	Maturity	Convertible
Collins Radio Company	4 7/8	1987	Yes
Columbia Pictures Corp. (Columbia Pictures Industries, Inc.)	4 3/4	1987	Yes
Commercial Solvents Corp.	4 1/2	1991	Yes
Continental Airlines, Inc.	3 1/2	1992	Yes
Corn Products Company (CPC International, Inc.)	4 5/8	1983	No
E G & G, Incorporated	3 1/2	1987	Yes
FMC Corporation	4 1/4	1992	Yes
Food Fair Stores, Inc.	4	1979	No
General Electric Company	3 1/2	1976	No
General Host Corporation	6	1990	No
General Instrument Corp.	4 1/4	1985	Yes
General Motors Corp.	3 1/4	1979	No
Giddings & Lewis, Inc.	4 5/8	1987	Yes
Green Giant Company	4 1/4	1992	Yes
Grolier, Incorporated	4 1/4	1987	Yes
Grumman Aircraft Engineering Corporation (Grumman Corporation)	4 1/4	1992	Yes
Gulf & Western Industries, Inc.	6	1987	No
Helmerich & Payne, Inc.	5	1987	Yes
Howmet Corporation	4 1/2	1992	Yes
International Harvester Co.	4 5/8	1988	No

APPENDIX A

BOND ISSUES INCLUDED IN THE SAMPLE (Continued)

Issuing Firm	Contract Rate of Interest	Maturity	Convertible
International Minerals & Chemical Corp.	4	1991	Yes
International Silver Company (Insilco Corporation)	5	1993	Yes
Liggett & Meyers, Inc.	6	1992	No
Litton Industries, Inc.	3 1/2	1987	Yes
Lockheed Aircraft Corp.	4 1/4	1992	Yes
MSL Industries, Inc.	4 1/2	1984	Yes
Macke Company	4 7/8	1992	Yes
Macy, (R.H.) & Company, Inc.	4 1/4	1990	Yes
Madison Square Garden Corp.	6 1/4	1987	Yes
McCrory Corporation	5	1981	No
McDonnell Douglas Corp.	4 3/4	1991	Yes
Montgomery Ward & Company, Inc. (Marcor, Incorporated)	4 7/8	1990	No
National Biscuit Company (Nabisco, Incorporated)	4 3/4	1987	No
National Distillers & Chemical Corporation	4 1/2	1992	Yes
Northrop Corporation	4 3/4	1987	Yes
Oak Industries, Inc.	4 3/8	1987	Yes
Owens - Illinois Incorporated	4 1/2	1992	Yes
Pacific Southwest Airlines	6	1987	No
Penn-Dixie Cement Corporation (Penn-Dixie Industries Incorporated)	5	1982	Yes

APPENDIX A

BOND ISSUES INCLUDED IN THE SAMPLE (Continued)

Issuing Firm	Contract Rate of Interest	Maturity	Convertible
Radio Corporation of America (RCA Corporation)	4 1/2	1992	Yes
Reeves Brothers, Inc.	4	1991	Yes
Revere Copper & Brass, Inc.	5 1/2	1992	Yes
Reynolds Metals Company	4 1/2	1991	Yes
Rohr Industries, Inc.	5 1/4	1986	Yes
Sanders Associates, Inc.	5	1992	Yes
Sears, Roebuck & Company	4 3/4	1983	No
Shell Oil Company	5.30	1992	No
Skil Corporation	5	1992	Yes
Socony-Vacuum Oil Corporation (Mobil Oil Corp.)	2 1/2	1976	No
Sprague Electric Company	4 1/4	1992	Yes
Standard Oil Co. of California	4 3/8	1983	No
Standard Oil Co. (Indiana)	4 1/2	1983	No
Standard Oil Co. (New Jersey)	2 3/4	1974	No
Stauffer Chemical Company	4 1/2	1991	Yes
Stevens, (J.P.) & Company, Inc.	4	1990	Yes
Storer Broadcasting Co.	4 1/2	1986	Yes
Teledyne, Incorporated	3 1/2	1992	Yes
Tenneco Corporation	6 1/4	1992	Yes
Texaco Incorporated	5 3/4	1997	No
Trans-World Airlines, Inc.	4	1992	Yes
Union Carbide Corporation	5.30	1997	No

APPENDIX A

BOND ISSUES INCLUDED IN THE SAMPLE (Continued)

Issuing Firm	Contract Rate of Interest	Maturity	Convertible
United Air Lines, Inc.	5	1991	Yes
United Merchants & Manufacturers Incorporated	4	1990	Yes
United States Steel Corporation	4	1983	No
Westinghouse Electric Corp.	5 3/8	1992	No
Weyerhaeuser Company	5.20	1991	No
White Consolidated Industries Incorporated	5 1/2	1992	Yes

APPENDIX B

COMPUTATION OF FACTOR ANALYSIS INDEX

APPENDIX B

COMPUTATION OF FACTOR ANALYSIS INDEX

In Chapter III a Factor Analysis Index of market return was used to remove from the return on a specific bond issue, issue i, during time period t that portion of the return which can be attributed to market-wide influences. This index was derived from the returns on eighty of the bond issues in the sample. (Five randomly selected firms were excluded from the BMD03M factor analysis due to a number-of-variables constraint of the BMD program.) The following is a model of the computations necessary to derive the index from the BMD03M output:[1]

$$FAI_t = \sum_{i=1}^{80} \left\{ \left[\frac{r_{it} - \bar{R}_i}{s_i} \right] \left[\frac{1}{\sqrt{\lambda_1}} (L_i) \right] \right\}$$

where:

FAI_t = an index of a market return during period t,

r_{it} = the return on bond issue i during period t,

$\bar{R}_i$ = the mean return per bi-weekly period on bond i during the five years in the study,

s_i = the standard deviation of the bi-weekly return on bond i during the five-year period,

---

[1] See W. J. Dixon, (ed). BMD: Biomedical Computer Programs (Los Angeles, 1971) for a description of the BMD03M factor analysis program output and William W. Cooley and Paul R. Lohnes, Multivariate Data Analysis (New York, 1971) pp. 110-114, for a more detailed analysis of principal components scores and their transformation to indices.

λ_1 = 19.279, eigenvalue associated with the first principle component,

L_i = the factor loading of firm i on principal component number one,

i = the values one through eighty for each firm included in the factor analysis, and

t = the values 1 through 131 for each bi-weekly period in the five years of the study.

VITA

Darrel Wilber Davis

Candidate for the Degree of

Doctor of Philosophy

Thesis: AN EMPIRICAL INVESTIGATION OF THE ASSOCIATION BETWEEN REPORTED EARNINGS AND CORPORATE BOND PRICES

Major Field: Business Administration

Biographical:

Personal Data: Born in State Center, Iowa, June 12, 1943, the son of Mr. and Mrs. Randall L. Davis.

Education: Graduated from Clemons Community High School, Clemons, Iowa, in May, 1960; received the Associate of Arts degree from Marshalltown Community College in June, 1962; received the Bachelor of Arts degree from the University of Northern Iowa in May, 1965, with a major in Business Education -- Accounting emphasis; received the Master of Arts degree from the University of Northern Iowa in August, 1969, with a major in Business Education -- Accounting emphasis; completed requirements for the Doctor of Philosophy degree at Oklahoma State University in July, 1975.

Professional Experience: Audit Staff Accountant, Price Waterhouse and Company, Chicago, 1965-1968; assistant professor, Department of Business, University of Northern Iowa, 1969-1972; graduate teaching assistant, Department of Accounting, Oklahoma State University, 1972-1974; visiting professor, Department of Accounting, University of Texas-Austin, 1975.